CHAPTER 3.0
ALTERNATIVES FOR THE CONTINUED OPERATION OF THE LOS ALAMOS NATIONAL LABORATORY

This chapter describes the four alternatives DOE has analyzed in detail regarding the continued operation of LANL. Specifically, it describes the activities at LANL's key facilities that vary among the alternatives and the activities that are common to all alternatives. In addition, the chapter identifies the alternatives DOE considered, but has not analyzed in detail because they were not reasonable. The chapter concludes with a comparison of the environmental consequences of the four alternatives.

DOE is considering four alternatives for the continued operation of LANL to support its existing and potential future program assignments (described in SWEIS chapter 1, section 1.1). These alternatives are:

- No Action Alternative (section 3.1)
- Expanded Operations Alternative and Preferred Alternative (section 3.2)
- Reduced Operations Alternative (section 3.3)
- Greener Alternative (section 3.4)

The first three alternatives present differing operational levels of the same types of activities, with the No Action Alternative representing the currently planned levels of operation. The fourth (the Greener Alternative) emphasizes use of LANL capabilities in nonweapons missions, such as nonproliferation and nonweapons research. Some activities in the Greener Alternative are the same as in the No Action or Reduced Operations Alternatives. In other facilities, operations under the Greener Alternative are the same as those under the Expanded Operations Alternative, but they are conducted for nonproliferation, waste management, or other nonweapons purposes.

In the draft SWEIS, the DOE's Preferred Alternative was the Expanded Operations Alternative. In this final SWEIS, the Expanded Operations Alternative remains the Preferred

Alternatives Analyzed

No Action*—LANL operations would continue at their currently planned level.*

Expanded Operations*—implements all current DOE mission element assignments to LANL, including full implementation of those made in recent programmatic EIS (PEIS) Records of Decision, at the highest foreseeable levels of activity.*

Reduced Operations*—conducts the minimal levels of activities necessary to maintain the capabilities necessary to support DOE missions.*

Greener*—uses LANL capabilities to maximize support to DOE nonproliferation, basic science, and materials recovery/stabilization mission elements, and minimizes support to DOE defense and nuclear weapons mission elements.*

Preferred Alternative*—DOE has identified the Preferred Alternative as the Expanded Operations Alternative, with the exception that pit manufacturing would not be implemented at a 50 pits per year level, single shifts, but only at a level of 20 pits per year, in the near term.*

Alternative with one modification, as noted below. The modification to the Preferred Alternative involves the level at which pit manufacturing will be implemented at LANL. Under the Expanded Operations Alternative, DOE would expand operations at LANL, as the need arises, to increase the level of existing operations to the highest reasonably foreseeable levels, including the full implementation of pit manufacturing up to the capacity of 50 pits per year under single-shift operations (80 pits per year using multiple shifts). However, as a result of delays in the implementation of the Capability Maintenance and Improvement Project (CMIP) and recent additional controls and operational constraints in the Chemistry and Metallurgy (CMR) Building (instituted to ensure that the risks associated with the CMR Building operations are maintained at an acceptable level), DOE has determined that additional study of methods for implementing the 50 pits per year production capacity is warranted. In effect, because DOE has postponed any decision to expand pit manufacturing beyond a level of 20 pits per year in the near future, the revised Preferred Alternative would only implement pit manufacturing at this level. This postponement does not modify the long-term goal announced in the Record of Decision (ROD) for the Stockpile Stewardship and Management Programmatic EIS (SSM PEIS) (up to 80 pits per year using multiple shifts).

LANL's direct-funded and support activities are described in general terms in SWEIS chapter 2, sections 2.1.1 and 2.1.2, respectively. In addition, the operations of 15 key facilities are described in section 2.2.2. Those direct-funded and support activities that occur outside of the key facilities will not change among the alternatives (outside the expected variability due to the dynamic nature of research and development, as discussed in section 2.1). Thus, the alternatives for continued operations of LANL focus on four differing levels of operation at the key facilities.

Some Terminology Notes

Activities—*The specific research and development, experimentation, and studies conducted at LANL under assignment from DOE or through DOE by assignment from other government entities, industries, or organizations. This definition includes facility or technical area operations, as well as studies, monitoring, and other actions DOE may cause to be undertaken to manage and maintain LANL.*

Operations—*This term is used in two senses in this document. The first is the overall continuing use of the capabilities of LANL. The second sense is specific to facilities and technical areas (TAs), the subset of activities undertaken. Examples are accelerator operations or activities that are procedure-controlled such as movement of appreciable quantities of special materials, including special nuclear materials, through process lines such as gloveboxes resulting in one or more products and waste.*

Facility—*One or more buildings in a technical area of LANL that house specific activities.*

Capability—*The combination of equipment, facilities, infrastructure, and expertise required to undertake types or groups of activities and to implement assignments. Using a capability results in facility or technical area operations (see the second use of operations above).*

Many of these key facilities are primarily engaged in supporting the national security mission. Additionally, the key facilities include those that may be upgraded and modified to implement the ROD of the programmatic NEPA documents addressing stockpile stewardship and management, waste management, and disposition of weapons-usable fissile materials. Other key facilities are engaged in neutron science and research and development efforts such as materials research, radiochemistry, and health research. By using this approach, DOE has examined in the greatest detail the LANL facilities and activities that are critical to meeting mission element assignments at LANL, could result in the most significant health and/or environmental impacts, are of most interest or concern to the public, and are the most subject to change across the alternatives due to recent programmatic decisions.

For clarity and brevity, the descriptions of the alternatives in the text (sections 3.1, 3.2, 3.3, and 3.4) and in the tables (section 3.6) in this chapter focus on significant "markers" to characterize the variation of activities across alternatives. More complete descriptions of the activities at LANL are provided by facility in chapter 2 (section 2.2), and all of these activities were projected and used in evaluating the impacts of each alternative.

> ***Key Facilities in the SWEIS***
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> *While the SWEIS analyzes the ongoing and future (reasonably foreseeable within the next 10 years) activities throughout LANL, DOE has identified 15 key facilities that account for a large majority of the issues and impacts addressed in the SWEIS. Alternatives analyzed for continued operations at LANL focus on differing levels of activities conducted in the key facilities. Alternative operating levels of key facilities are analyzed in detail because such operations are critical to meeting assignments at LANL, and: they could result in the most significant health or environmental impacts; or they are of most interest or concern to the public; or they are the most subject to change due to recent programmatic decisions. Descriptions of key facilities and their operations are presented* in *section 2.2.2. However, a large amount of the research and development and experimental work conducted at LANL does not occur in the key facilities and, for the purposes of this analysis, is not expected to change outside of the variation that is typical of research and development activities.*

Where consolidation of operations is appropriate in a specific alternative, the cleanup of the excess facilities or space is reflected in the description of that alternative. At a minimum, estimates were made of consequences of activities undertaken to place such facilities in a "secure safe shutdown" condition. These facilities retain negligible inventories of radioactive or hazardous materials and await decontamination or renovation for other use of the space. A few of these are already scheduled for decommissioning as part of the LANL Environmental Restoration (ER) Project, described in chapter 2, section 2.1.2.5.

All of the alternatives include the activities or projects for which NEPA analysis and documentation already exist and on which DOE has already made a decision. DOE is not revisiting any programmatic decisions made through its NEPA process, such as those addressing weapons complex consolidation and reconfiguration, materials disposition, or waste management.

Although DOE is not addressing changes to LANL's mission element assignments, it does analyze the site-specific implementation of assignments that were analyzed in other programmatic NEPA documents. Specifically, the SWEIS evaluates the impacts of continuing and planned activities, representing a range of operational levels that could be reasonably implemented in the 10-year time frame of the SWEIS analysis. Inclusion of these activities in the SWEIS is intended to provide DOE, and the public, with a better understanding of the total consequences of the alternatives for continued operations of LANL.

For a variety of reasons (including the variability inherent in research and development activities), no one condition and time was simultaneously typical of all LANL activities. Therefore, an index was established for operations in each key facility and for each parameter used to evaluate impacts. The index contains the best data set from historical records that could be used to describe conditions associated with activities expected in the future. This index was used as a base to project levels of activity with associated impact parameters for the various alternatives.

As noted above, sections 3.1, 3.2, 3.3, and 3.4 present the four SWEIS alternatives. Section 3.5 describes other alternatives that DOE considered, but did not analyze in detail in the SWEIS. Section 3.6 provides a comparison of the changes across the alternatives and of the environmental impacts associated with each of the alternatives.

3.1 NO ACTION ALTERNATIVE

The Council on Environmental Quality (CEQ) NEPA implementing regulations (40 CFR 1500 through 1508) require analysis of the No Action Alternative to provide a benchmark against which the impacts of the other alternatives can be compared. In the SWEIS, the No Action Alternative is a projection over the next 10 years, from the index established for past operations, of a level of activity for facility operations that would implement current management plans for assigned programs.

These planned actions include: continued support of major DOE programs including defense programs, nuclear energy, fissile material disposition, environmental management, and energy research; projects to maintain existing facilities and capabilities; and projects previously receiving NEPA reviews resulting in decisions (e.g., the CMR Building Phase I and Phase II Upgrades). The plans utilized in preparing the description of the No Action Alternative include the Capital Assets Management Process, DOE Program Plans, Site Development Plans for LANL, interagency agreements between DOE and the U.S. Department of Defense (DoD), PEISs, Presidential Directives, and the DOE Work for Others proposals and guidance. The planned activities reflected in this alternative include an increase in some LANL operations and activities over the actions in previous years (e.g., the suspension of underground nuclear testing results in increased stockpile stewardship activities at LANL).

Organization of SWEIS Chapter 3

Sections 3.1 through 3.4 *describe the activities that would occur at each of the key facilities under each of the four alternatives.*

Section 3.5 *describes alternatives that DOE considered, but did not analyze in detail because they are unreasonable.*

Section 3.6 *compares the environmental consequences of the alternatives.*

The No Action Alternative also includes continued scientific, engineering, technology research and development, and support activities throughout LANL, including those at the SWEIS key facilities. By the very nature of research and development, specific activities are expected to vary and evolve through time. However, they can be sufficiently characterized to assure the analysis of their consequences in the SWEIS. (For the non-key facilities, chapter 2, section 2.1 provides this description.) This alternative includes foreseeable construction projects that are required to maintain facilities necessary for currently authorized activities, and this SWEIS is the entire NEPA review for these activities.

3.1.1 Plutonium Facility Complex

The Plutonium Facility (PF) Complex (TA–55) is described in chapter 2, section 2.2.2.1. Under the No Action Alternative, the following activities would occur at this complex.

Plutonium Stabilization. LANL would recover, process, and store its existing plutonium residue inventory in 8 years.

Manufacturing Plutonium Components. LANL would produce up to 14 plutonium pits per year (its existing capacity), as well as fabricate parts and samples for research and development activities (including parts for subcritical experiments).

Surveillance and Disassembly of Weapons Components. LANL would disassemble up to 40 plutonium pits per year (including up to 20 pits that would be destructively examined). In addition, up to 20 pits per year would be nondestructively examined.

Actinide Materials Science and Processing Research and Development. Research, as described in chapter 2 (section 2.2.2.1), would continue to be conducted on plutonium (and other actinide) materials, including metallurgical and other characterization of samples and measurements of mechanical and physical properties. This would include continued operation of the 40-millimeter Impact Test Facility and other apparatus. Research also would be conducted to develop new techniques useful for such research or for enhanced surveillance. In addition, LANL would perform research supporting development and assessment of technology for manufacturing and fabrication of components, including activities in areas such as welding bonding, fire resistance, and casting, machining, and other forming technologies.

LANL would demonstrate the disassembly/ conversion of 1 to 2 pits per day (up to 40 pits total) using hydride-dehydride processes. Up to 1,000 curies of neutron sources (plutonium-239/ beryllium and americium-241/beryllium) and up to 220 pounds (100 kilograms) of actinides would be processed each year. LANL would process up to 12 items per year (1 to 2 items per month) through tritium separation and would perform decontamination (to remove plutonium) of 15 to 20 uranium components per month.

Research on the physical and chemical characteristics of actinides and in support of DOE's actinide cleanup activities and on actinide processing and waste activities at DOE sites would be conducted. In addition, LANL would stabilize minor quantities of specialty items and residues from other DOE sites, fabricate and study small amounts of nuclear fuels used in terrestrial and space reactors, fabricate and study prototype fuel for lead test assemblies, develop safeguards instrumentation for plutonium assay, and analyze samples.

Fabrication of Ceramic-Based Reactor Fuels. LANL would make prototype mixed oxide (MOX) fuel and continue research and development on other fuels.

Plutonium-238 Research, Development, and Applications Processing. LANL would process, evaluate, and test up to 55 pounds (25 kilograms) of plutonium-238 per year in production of materials and parts to support space and terrestrial uses. In addition, up to 22 pounds (10 kilograms) of plutonium-238 per year would be processed to recover material from heat sources and milliwatt generators, research and development, and safety testing.

Storage, Shipping, and Receiving. As under all alternatives, the Nuclear Material Storage Facility (NMSF) is to be renovated to perform as originally intended: to serve as a centralized receiving area and vault for the interim storage of up to 7.3 tons (6.6 metric tons) of the LANL special nuclear material (SNM) inventory, mainly plutonium. This is expected to be an adequate capacity to allow the PF-4 vault to return to its intended use as a working vault and to accommodate the projected inventory growth at LANL (approximately 287 pounds [130 kilograms] per year under all alternatives—refer to volume III, appendix F, section F.5.3). The NMSF renovation is included in all alternatives. Once renovation is complete, nuclear materials will be moved to the NMSF from other LANL vaults and from other DOE facilities as necessary to support tasks assigned to LANL. Nondestructive assays would be conducted on SNM at the NMSF to verify and identify the content of stored containers. Material stored would be limited to nuclear material in metal or oxide forms. Nuclear material solutions and tritium would not be stored in NMSF, although some may be accepted at the receiving area and redirected to other facilities within the same day.

Under all alternatives, the Plutonium Facility would be renovated to ensure the continued availability of existing capabilities under all alternatives. Activities to be included in all alternatives as renovation that will ensure continued availability of the Plutonium Facility's existing capabilities are:

- Improvements to utilities that increase reliability
- Emergency lighting and interior improvements to meet fire and life safety code requirements
- Replacement of components in the process waste treatment systems
- Replacement of outdated laboratory equipment
- Improvements to communication and fire alarm systems
- Electrical system improvements

It is recognized that project plans can change over time. If this alternative is selected, the construction projects proposed under this alternative, as described above, would be reviewed prior to construction to determine whether additional NEPA analysis is required.

3.1.2 Tritium Facilities

The Tritium Facilities are described in chapter 2 (section 2.2.2.2). Under the No Action Alternative, the following activities would occur at these facilities.

High Pressure Gas Fills and Processing. LANL would handle and process tritium gas in quantities of up to 3.53 ounces (100 grams) at the Weapons Engineering Tritium Facility (WETF) approximately 25 times per year.

Gas Boost System Testing and Development. Approximately 20 times per year, LANL would conduct gas boost system research, development, and testing and gas processing operations at WETF involving quantities of up to 3.53 ounces (100 grams) of tritium.

Cryogenic Separation. At the Tritium Systems Test Assembly (TSTA), LANL would purify and process tritium gas in quantities of up to 7.06 ounces (200 grams) approximately 3 times per year using cryogenic separation.

Diffusion and Membrane Purification. LANL would conduct research on tritium movement and penetration through materials, including major experimental efforts, approximately 2 to 3 times per month.

Metallurgical and Material Research. LANL would also conduct metallurgical and materials research involving tritium, including research and application studies regarding tritium storage.

Thin Film Loading. LANL would use its thin film loading capability (involving chemically bonding tritium to a metallic surface) for tritium loading of neutron tube targets, processing approximately 800 units per year.

Gas Analysis. LANL's activities to measure the composition and quantities of gases used would continue in support of tritium operations under this alternative.

Calorimetry. LANL would also continue its calorimetry measurements (a nondestructive method of measuring the amount of tritium in a container) in support of tritium operations under this alternative.

Solid Material and Container Storage. Tritium would continue to be stored on site in WETF, TSTA, and the Tritium Science and Fabrication Facility (TSFF). Storage of tritium occurs in process systems, process samples, inventory for use, and waste.

Under all alternatives, LANL would remodel Building 16-450 and connect it to WETF in support of neutron tube target loading, as discussed in chapter 2 (section 2.2.2.2).

3.1.3 Chemistry and Metallurgy Research Building

The CMR Building is described in section 2.2.2.3. Under the No Action Alternative, the following activities would occur at this facility.

Analytical Chemistry. LANL would provide sample analysis in support of actinide research and processing activities, processing approximately 5,200 samples per year.

Uranium Processing. LANL would conduct activities to recover, process, and store LANL's highly enriched uranium inventory over the next 8 years.

Destructive and Nondestructive Analysis. Up to a total of 10 secondary assemblies over the next 10 years (an average of 1 each year) would be evaluated through destructive and nondestructive analysis and disassembly.

Nonproliferation Training. LANL would conduct nonproliferation training using SNM.

Actinide Research and Processing. LANL would process up to 3,600 curies of plutonium-238/beryllium neutron sources and up to 500 curies of americium-241/beryllium neutron sources per year. In addition, up to 1,000 plutonium-238/beryllium and americium-241/beryllium neutron sources would be staged in CMR Building Wing 9 floor holes. LANL would retain its capability for research and development activities on spent nuclear fuels. Further, LANL would characterize approximately 50 samples per year using metallurgical microstructural/chemical analysis and would conduct compatibility testing of actinides and other metals in order to study long-term aging and other material effects. LANL would also conduct analysis of transuranic (TRU) waste disposal related to the validation of Waste Isolation Pilot Plant (WIPP) performance assessment models, characterize TRU waste, and analyze gas generation such as that which could occur during transportation to WIPP. LANL would continue to develop, demonstrate, and test nondestructive assay and evaluation equipment.

Fabrication and Metallography. LANL would produce 1,080 targets per year for production of molybdenum-99, with each target containing approximately 0.71 ounces (20 grams) of uranium-235. In addition, LANL would support highly enriched uranium processing, research and development, pilot operations, and casting and fabrication of metal shapes using from 2.2 to 22 pounds (1 to 10 kilograms) of highly enriched uranium in each operation, with an annual throughput of approximately 2,200 pounds (1,000 kilograms) (which would remain in the LANL material inventory).

Four construction or facility modification projects are currently in development or implementation at the CMR Building and are included in all alternatives (all have previously been reviewed under NEPA), as discussed in section 2.2.2.3:

- CMR Building Phase I Upgrades (ongoing)
- CMR Building Phase II Upgrades (DOE 1997)
- Medical Radioisotope Target Fabrication (DOE 1996c)
- Radioactive Source Recovery Program (DOE 1995d)

3.1.4 Pajarito Site (Los Alamos Critical Experiments Facility)

The Pajarito Site is described in detail in section 2.2.2.4. Under the No Action Alternative, the following activities would occur at this facility.

LANL would continue to conduct experiments and tests in all areas described in chapter 2, section 2.2.2.4. In 1997, up to 570 experimental operations would be expected; annual growth of about 5 percent is anticipated over the next 10 years to meet the planned research and development needs of DOE and other sponsors.

In addition, LANL would develop safeguards instrumentation and research and development activities for SNM, light detection and ranging experiments, materials processing, interrogation techniques, and field systems.

3.1.5 Sigma Complex

The Sigma Complex is described in section 2.2.2.5. Under the No Action Alternative, the following activities would occur at this complex.

Research and Development on Materials Fabrication, Coating, Joining, and Processing. LANL would continue to fabricate items from metals, ceramics, salts, beryllium, enriched uranium, depleted uranium, and other uranium isotope mixtures. Activities include casting, forming, machining, polishing, coating, and joining.

Characterization of Materials. LANL would continue research and development activities on properties of ceramics, oxides, silicides, composites, and high-temperature materials; analyze up to 24 tritium reservoirs per year; and develop a library of aged non-SNM materials from stockpiled weapons and develop techniques to test and predict changes. Up to 250 non-SNM samples, including uranium, would be stored and characterized.

Fabrication of Metallic and Ceramic Items. LANL would, on an annual basis, fabricate stainless steel and beryllium components for approximately 50 plutonium pits, 50 to 100 reservoirs for tritium, components for up to 50 secondary assemblies (of depleted uranium, depleted uranium alloy, enriched uranium, deuterium, and lithium), nonnuclear components for research and development (30 major hydrotests and 20 to 40 joint test assemblies, beryllium targets, targets and other components for accelerator production of tritium research, test storage containers for nuclear materials stabilization, and nonnuclear (stainless steel and beryllium) components for up to 20 plutonium pit rebuilds.

In addition, all of the alternatives include construction, renovation, and modification projects that are underway and planned in the near term for the purpose of maintaining the availability and viability of the Sigma Complex:

- *Sigma Building Renovation.* These renovations, described further below, are required to keep the building in good operating condition for current missions.
- *Nonnuclear Consolidation/Pit Support and Beryllium Technology Support.* This was previously reviewed under NEPA (DOE 1993), as discussed in section 2.2.2.5.

Typical activities to be included for the Sigma Building (SM–66) in all alternatives to ensure continued availability of the existing capabilities are:

- Perform seismic upgrades including adding shear walls and reinforcements.
- Replace the roof.
- Replace and upgrade the graphite collection systems.
- Replace the cooling water pump and piping.

- Modify the industrial drain system.
- Replace and upgrade electrical components.
- Perform site work such as relocating a fire hydrant, repairing the dock area, and removing unneeded exterior equipment.

In addition, at one of the shops (SM–106), the baghouse on the ventilation system will be replaced with new ductwork and a high-efficiency particulate air (HEPA) filter system.

It is recognized that project plans can change over time. If this alternative is selected, the construction projects proposed under this alternative, as described above, would be reviewed prior to construction to determine whether additional NEPA analysis is required.

3.1.6 Materials Science Laboratory

The Materials Science Laboratory (MSL) is described in chapter 2 (section 2.2.2.6). Under the No Action Alternative, the following activities would occur at this facility.

Materials Processing. LANL would continue research at the MSL at current levels of operation, including synthesis and processing techniques, wet chemistry, thermomechanical processing, microwave processing, heavy equipment materials, single crystal growth, amorphous alloys, and powder processing.

Mechanical Behavior in Extreme Environments. LANL would continue mechanical testing, dynamic testing, and fabrication and assembly research at current levels of operation.

Advanced Materials Development. LANL would continue research in materials, synthesis and characterization, ceramics, and superconductors at current levels of operation.

Materials Characterization. LANL would also continue activities in these six areas at current levels of operation: surface science chemistry, corrosion characterization, electron microscopy, x-ray, optical metallography, and spectroscopy.

3.1.7 Target Fabrication Facility

The TFF described in section 2.2.2.7. Under the No Action Alternative, TFF materials research, development, effects studies, and characterization work would continue at current levels, along with the following activities.

Precision Machining and Target Fabrication. LANL would provide targets and specialized components for approximately 1,200 laser and physics tests per year, including a 10 percent annual growth in operations for the next 10 years.

Polymer Synthesis. LANL would produce polymers for targets and specialized components for approximately 1,200 laser and physics tests per year, including a 10 percent annual growth in operations for the next 10 years.

Chemical and Physical Vapor Deposition. LANL would coat targets and specialized components for approximately 1,200 laser and physics tests per year, including a 10 percent annual growth in operations for the next 10 years. This would also support plutonium pit manufacturing operations (as discussed in section 3.1.1).

3.1.8 Machine Shops

The Machine Shops are described in chapter 2 (section 2.2.2.8). Under the No Action Alternative, the following activities would occur at these facilities.

The Machine Shops would provide fabrication support for the dynamic experiments program and explosive research studies, support up to 30 hydrodynamic tests annually, manufacture 20 to

40 joint test assembly sets annually, and provide general laboratory fabrication support as requested. LANL would also continue its fabrication activities using unique and unusual materials and provide appropriate dimensional inspection of these activities.

3.1.9 High Explosives Processing Facilities

The High Explosives Processing Facilities are described in chapter 2 (section 2.2.2.9). The operations listed below are expected to require a total of 46,750 pounds (21,200 kilograms) of explosives annually and 1,590 pounds (720 kilograms) of mock explosives. (This is considered an appropriate indicator of overall activity levels for this key facility.) Under the No Action Alternative, the following activities would occur at these facilities.

High Explosives Synthesis and Production. LANL would continue its current level of high explosives synthesis and production research and development, produce new materials and formulate plastic-bonded explosives as needed. Process development would increase over current levels and materials would be produced for research and stockpile applications.

High Explosives and Plastics Development and Characterization. LANL would evaluate stockpile returns and increase efforts in development and characterization of new plastics and high explosives for stockpile improvement. LANL would also improve its predictive capabilities and conduct research into high explosives waste treatment methods.

High Explosives and Plastics Fabrication. LANL would continue its traditional stockpile surveillance and process development and would supply parts to Pantex for surveillance, war reserve (WR) rebuilds, and joint test assemblies. Fabrication for hydrodynamic and environmental testing would be increased over current levels.

Test Device Assembly. Operations would be increased over current levels to support stockpile related hydrodynamic tests, joint test assemblies, environmental and safety tests, and research and development activities. Approximately 30 major hydrodynamic test devices would be assembled annually.

Safety and Mechanical Testing. Safety and environmental testing related to stockpile assurance would be increased over current levels and predictive models would be improved. Approximately 12 safety and mechanical tests would be conducted annually.

Research, Development, and Fabrication of High-Power Detonators. LANL would increase efforts to support SSM activities, manufacture up to 20 major product lines per year, and support DOE-wide packaging and transportation of electro-explosive devices.

3.1.10 High Explosives Testing

High explosives testing is described in section 2.2.2.10. The No Action Alternative includes approximately 600 experiments per year of varying degrees and types at the high explosives testing firing sites. Up to 30 of these would be characterized as major hydrodynamic tests. Firing site activities would include expenditures of materials, which are considered to be useful indicators of overall test activity. Under this alternative, about 2,900 pounds (1,320 kilograms) of depleted uranium would be expended annually. This is considered to be the minimum level required for the maintenance of capabilities, including staff expertise and equipment, and the recertification of the safety and reliability of the nuclear weapons stockpile. The operation of the Dual Axis Radiographic Hydrodynamic Test (DARHT) facility is included in all alternatives, using phased containment as described in the Final DARHT EIS (DOE 1995c).

Under the No Action Alternative, the following activities would occur.

Hydrodynamic Tests. LANL would conduct hydrodynamic tests, develop containment technology, and conduct tests of weapons configurations. Up to 30 of these per year would be characterized as major hydrodynamic tests.

Dynamic Experiments. LANL would conduct dynamic experiments to study properties and enhance understanding of the basic physics and equation of state and motion for materials used in nuclear weapons, including some experiments with SNMs.

Explosives Research and Testing. High explosives tests would be conducted to characterize explosive materials.

Munitions Experiments. LANL would continue to support the DoD with research and development on conventional munitions, conducting experiments with projectiles, and studying other effects of munitions.

High Explosives Pulsed-Power Experiments. LANL would conduct high explosives pulsed-power experiments and development tests.

Calibration, Development, and Maintenance Testing. LANL would conduct tests to provide calibration data, instrumentation development, and maintenance of image processing capability.

Other Explosives Testing. LANL would also conduct advanced high explosives or weapons evaluation studies.

3.1.11 Los Alamos Neutron Science Center

The Los Alamos Neutron Science Center (LANSCE) is described in chapter 2 (section 2.2.2.11). Under the No Action Alternative, the following activities would occur at this facility.

Accelerator Beam Delivery, Maintenance, and Development. LANSCE would deliver a linear accelerator beam to Areas A, B, and C; the Weapons Neutron Research (WNR) buildings; Manuel Lujan Center; radiography firing sites; and a new Isotope Production Facility (IPF) for 8 months each year (5,100 hours). The H^+ beam current would be 1,000 microamps, and the H^- beam current would be 200 microamps. The beam delivery and support equipment would be reconfigured to support new facilities, upgrades, and experiments.

A 40-million electron volt low-energy demonstration accelerator (LEDA) would be built and operated in an existing facility (TA–53–365) for 6 years, operating up to approximately 6,600 hours per year. LEDA would be used to demonstrate the practicality of using continuous-wave accelerator beam technology to produce tritium, as an alternative to the historical use of nuclear reactors. This facility would be located in existing Building 53–365, as described in section 2.2.2.11.

The LEDA building consists of two major parts: an underground, shielded beam tunnel (16,200 square feet [1,500 square meters]) and a four-story, steel-frame building (53,800 square feet [5,000 square meters]). The heating, ventilation, and air conditioning system would allow short-lived radioisotopes to decay in the beam tunnel prior to release via the 82-foot-high (25-meter-high) exhaust stack.

The construction and operation of LEDA was analyzed under NEPA in an environmental assessment that supported a finding of no significant impact (DOE 1996b).

Experimental Area Support. Support activities would continue to ensure availability of the beam lines, beam line components, handling and transportation systems, and shielding, as well as radiofrequency power sources (including technology development and application). Remote handling and packaging of radioactive materials and wastes at LANSCE would be maintained at fiscal year 1994 levels.

Neutron Research and Technology. LANL would conduct 500 to 1,000 different experiments annually, using neutrons from the Manuel Lujan Center and the WNR Facility. LANL would also conduct an accelerator production of tritium target neutronics experiment for 6 months. In addition, LANL would continue to support contained weapons-related experiments using small to moderate quantities of high explosives. These experiments would include:

- Experiments with nonhazardous materials and small quantities of high explosives (up to approximately 100 per year)
- Experiments with up to 10 pounds (4.54 kilograms) of high explosives and/or depleted uranium (up to approximately 30 per year)
- Experiments with small quantities of actinides, high explosives, and sources (up to approximately 40 per year)
- Shockwave experiments involving small amounts, up to nominally 0.18 ounces (5 grams), of plutonium

In addition, LANL would provide support for static stockpile surveillance technology research and development.

Accelerator-Driven Transmutation Technology. LANL would conduct lead target tests for 2 years at the Area A beam stop, establish a 1-megawatt target/blanket experimental area at one existing target area in Area A, and conduct low-power (less than 1 megawatt) experiments during the 8 months of accelerator operations per year for 4 years.

Subatomic Physics Research. LANL would conduct five to ten physics experiments annually at the Manuel Lujan Center and WNR and conduct proton radiography experiments. Proton radiography experiments would include contained experiments using small to moderate quantities of high explosives, similar to those discussed above under Neutron Research and Technology.

Medical Isotope Production. Up to approximately 40 targets per year would be irradiated for medical isotope production.

High-Power Microwaves and Advanced Accelerators. Research and development would be conducted for advanced accelerator concepts, high-power microwaves, room-temperature and superconducting linear accelerator structures, and in support of the Spallation Neutron Source Program. Research and development also would be conducted in microwave chemistry for industrial and environmental applications.

Under all alternatives, the following facilities would be constructed and operated based on previous NEPA reviews, as discussed in chapter 2 (section 2.2.2.11):

- The LEDA would be constructed.
- Proton radiography and neutron spectroscopy facilities (for neutron research and technology) would be constructed within existing buildings and would house photographic equipment and experiments contained within closed vessels.
- IPF (for medical isotope production) and equipment would be relocated to a new 100-million electron volt station, instead of using the full 800-million electron volt beam as is currently done.
- The short-pulse spallation source (SPSS) enhancement will result in higher neutron flux and greater beam availability for experimenters in WNR and the Manuel Lujan Center.

It is recognized that project plans can change over time. If this alternative is selected, the construction projects proposed under this alternative, as described above, would be reviewed prior to construction to determine whether additional NEPA analysis is required.

3.1.12 Health Research Laboratory

The Health Research Laboratory (HRL) is described in section 2.2.2.12. Under the No Action Alternative, the following activities would occur at this facility.

Genomic Studies. LANL would continue to conduct research at current levels using molecular and biochemical techniques to analyze the genes of animals, particularly humans. Specifically, personnel are developing strategies to analyze the nucleotide sequence of individual genes, especially those associated with genetic disorders, and to identify their map genes and/or genetic diseases to locations on individual chromosomes. Part of this work is to map each nucleotide, in sequence, of each gene in all 46 chromosomes of the human genome.

Cell Biology. LANL would continue to conduct research at current levels using whole cells and cellular systems, both in-vivo and in-vitro, to investigate the effects of natural and catastrophic cellular events such as response to aging, harmful chemical and physical agents, and cancer.

Cytometry. LANL would also conduct research utilizing laser imaging systems to analyze the structures and functions of subcellular systems.

DNA Damage and Repair. LANL would conduct research using isolated cells to investigate deoxyribonucleic acid (DNA) repair mechanisms.

Environmental Effects. LANL would conduct research that identifies specific changes in DNA and proteins in certain microorganisms that occur after events in the environment.

Structural Cell Biology. LANL would conduct research utilizing chemical and crystallographic techniques to isolate and characterize the three dimensional shapes and properties of DNA and protein molecules.

Neurobiology. LANL would conduct research using magnetic fields produced in active areas of the brain to map human brain locations associated with certain sensory and cognitive functions.

In-Vivo Monitoring. LANL would also continue to conduct 1,500 whole-body scans annually as a service that supports operations with radioactive materials conducted elsewhere at LANL.

3.1.13 Radiochemistry Facility

The Radiochemistry Facility is described in chapter 2 (section 2.2.2.13). Overall, levels of activity under this alternative would remain at current levels. Because much of the work here is research and development work, one indicator of activity levels is employment. This alternative would be expected to utilize about 170 full-time equivalent employees (FTEs) to perform the activity below. Under the No Action Alternative, the following activities would occur at this facility.

Radionuclide Transport. LANL would conduct 45 to 80 of these studies annually.

Environmental Remediation. Environmental remediation activities would continue to provide field support at current levels.

Ultra-Low-Level Measurements. These activities would continue at current levels.

Nuclear/Radiochemistry. These operations would also continue at current levels.

Isotope Production. LANL would conduct target preparation, irradiation, and processing to recover medical and industrial application isotopes at current levels.

Actinide/Transuranic Chemistry. LANL would perform radiochemical separations at the current level of operations.

Data Analysis. LANL would continue to re-examine archive data and measure nuclear process parameters of interest to weapons radiochemists at current levels.

Inorganic Chemistry. LANL would conduct these activities at current levels.

Structural Analysis. LANL would continue these activities at current levels of operation.

Sample Counting. LANL's sample counting activity to measure the quantity of radioactivity in samples would continue at current levels.

3.1.14 Radioactive Liquid Waste Treatment Facility

The Radioactive Liquid Waste Treatment Facility (RLWTF) is described in chapter 2 (section 2.2.2.14). Under the No Action Alternative, the following activities would occur at this facility.

Waste Characterization, Packaging, and Labeling. LANL would support, certify, and audit generator characterization programs and maintain the waste acceptance criteria (WAC) for the RLWTF.

Waste Transport, Receipt, and Acceptance. LANL would collect radioactive liquid waste from generators and transport it to the RLWTF in TA–50.

Radioactive Liquid Waste Pretreatment. LANL would pretreat 185,000 gallons (700,000 liters) of radioactive liquid waste per year at TA–21; 7,900 gallons (30,000 liters) of radioactive liquid waste per year at TA–50; and solidify, characterize, and package 71 cubic feet (2 cubic meters) of TRU waste sludge per year at TA–50.

Radioactive Liquid Waste Treatment. LANL would install equipment for nitrate reduction in mid 1999, treat 6,600,000 gallons (25 million liters) of radioactive liquid waste (RLW) per year; dewater, characterize, and package 247 cubic feet (7 cubic meters) of low-level radioactive waste (LLW) sludge per year; and solidify, characterize, and package 812 cubic feet (23 cubic meters) of TRU waste sludge per year.

Decontamination Operations. LANL would:

- Decontaminate personnel respirators for reuse (approximately 500 per month).
- Decontaminate air-proportional probes for reuse (approximately 200 per month).
- Decontaminate vehicles and portable instruments for re-use (as required).
- Decontaminate precious metals for resale (acid bath).
- Decontaminate scrap metals for resale (sand blast).
- Decontaminate 6,710 cubic feet (190 cubic meters) of lead for reuse (grit blast).

Three modifications were recently completed or are planned for the RLWTF: an upgrade to the influent tank system, installation of a new process for treatment of RLW, and installation of additional treatment steps for removal of nitrates. These have all been previously reviewed under NEPA and are included in all of the SWEIS alternatives (these are discussed further in section 2.2.2.14).

3.1.15 Solid Radioactive and Chemical Waste Facilities

The Solid Radioactive and Chemical Waste Facilities are described in chapter 2 (section 2.2.2.15). Under the No Action Alternative, the following activities would occur at these facilities.

Waste Characterization, Packaging, and Labeling. LANL would support, certify, and audit generator characterization programs and maintain the WAC for LANL waste management facilities. At the Solid Radioactive and Chemical Waste facilities, LANL would characterize 26,830 cubic feet (760 cubic meters) of legacy low-level radioactive mixed waste (LLMW); characterize 318,000 cubic feet (9,010 cubic meters) of legacy TRU waste; verify characterization data at the Radioactive Assay and Nondestructive Test (RANT) Facility for unopened containers of LLW and TRU waste; maintain the WAC for off-site treatment, storage, and disposal facilities; and overpack and bulk waste containers.

LANL would also perform coring and visual inspection of a percentage of TRU waste packages, ventilate 16,700 drums of TRU waste retrieved during the TRU Waste Inspectable Storage Project (TWISP), and maintain the current version of the WIPP WAC and coordinate with WIPP operations.

Compaction. LANL would compact up to 614,000 cubic feet (17,400 cubic meters) of LLW.

Size Reduction. In addition, 91,800 cubic feet (2,600 cubic meters) of TRU waste would be reduced in size at the Waste Characterization, Reduction, and Repackaging (WCRR) Facility in TA–50 and the Drum Preparation Facility in TA–54.

Waste Transport, Receipt, and Acceptance. LANL would collect chemical and mixed wastes from LANL generators and transport them to TA–54. LANL would ship 31,960 tons (29,000 metric tons) of chemical wastes and 126,700 cubic feet (3,590 cubic meters) of LLMW for off-site treatment and disposal in accordance with EPA land disposal restrictions. In addition, LANL would ship 1,437,000 cubic feet (40,700 cubic meters) of LLW for off-site disposal. Beginning in 1999, 318,00 cubic feet (9,010 cubic meters) of legacy TRU waste would be shipped to WIPP. LANL would also ship 86,800 cubic feet (2,460 cubic meters) of TRU waste generated as a result of future operations and research to WIPP and 100,600 cubic feet (2,850 cubic meters) of LLMW in environmental restoration soils for off-site solidification and disposal.

Waste Storage. Prior to shipment to off-site treatment, storage, and disposal facilities, LANL would store chemical and mixed wastes. LANL would also continue to: store legacy TRU waste until WIPP is open for disposal; LLMW until treatment facilities are available; and LLW uranium chips until sufficient quantities were accumulated for stabilization campaigns.

Waste Retrieval. LANL would retrieve 165,900 cubic feet (4,700 cubic meters) of TRU waste from Pads 1, 2, and 4 by 2004.

Other Waste Processing. LANL would demonstrate treatment (e.g., electrochemical) of LLMW liquids, land farm oil-contaminated soils at Area J, stabilize 14,500 cubic feet (410 cubic meters) of uranium chips and provide special case treatment for 23,650 cubic feet (670 cubic meters) of TRU waste.

Disposal. LANL would dispose of 3,530 cubic feet (100 cubic meters) of LLW in shafts at Area G, 1,271,000 cubic feet (36,000 cubic meters) of LLW and small quantities of radioactively contaminated polychlorinated biphenyls (PCBs) in disposal cells at Area G, approximately 3,530 cubic feet (100 cubic meters) of administratively controlled industrial solid wastes in cells at Area J annually, and nonradiological classified wastes in shafts at Area J.

In addition, under all alternatives, LANL would construct TRU Waste Inspectable Storage Project storage domes for TRU wastes recovered from Pads 1, 2, and 4, as described in section 2.2.2.15. This proposal has been reviewed under NEPA and is included under all four alternatives.

3.2 EXPANDED OPERATIONS ALTERNATIVE

The Expanded Operations Alternative for the SWEIS reflects the implementation of assignments at higher levels of operations through much of LANL. This alternative includes full implementation of new mission element assignments as defined in RODs of DOE programmatic NEPA documents such as the SSM PEIS (DOE 1996a). This activity level is a projection from the index established for past operations and represents a level that is possible to attain within a 10-year period, given an increased level of funding for programs, consistent with current and newly assigned LANL missions. DOE's Preferred Alternative is the Expanded Operations Alternative, with the exception that pit manufacturing would not be implemented at a 50 pits per year level, single shifts, but only at a level of 20 pits per year in the near term.

New facilities and modifications to existing facilities that are necessary to support projected capabilities and operations levels considered in this alternative are also analyzed. Specifically, construction and/or modifications are analyzed that could be required to optimize facilities for increased levels of operations and to increase capabilities or capacities where necessary.

The construction and upgrade projects associated with the Expanded Operations Alternative are identified in the descriptions of activities under this alternative for each of the key facilities. This SWEIS constitutes the entire NEPA review for these projects.

In particular, the Expanded Operations Alternative includes the project-level analyses for the Expansion of TA–54/Area G and for the Enhancement of Pit Manufacturing (to implement the pit production mission element assignment at LANL), including the siting and construction analyses detailed in volume II of this SWEIS. While the full implementation of the pit production mission at LANL is expected to continue beyond the period of time covered in this SWEIS, the impacts are projected based on the best available information. The first phase of this proposed action (establishing pit production at a 20 pits per year rate, DOE's Preferred Alternative) is discussed in this alternative, and the impacts associated with that level of operation are presented in chapter 5 of this SWEIS, as are the impacts of full implementation of pit production at the 80 pits per year level (using multiple shifts).

The selection of the Preferred Alternative as the Expanded Operations Alternative, but only at pit manufacturing rate of 20 pits per year, is influenced by several factors, including:

- DOE's obligation to assure a safe and reliable nuclear weapons stockpile
- The unique capabilities (facilities, equipment, instrumentation, and expertise) at LANL that support DOE's obligation to assure a safe and reliable nuclear weapons stockpile
- The continued consolidation and downsizing of the DOE weapons complex, increasing demands on the remaining facilities and capabilities
- The U.S. policy decision to suspend underground nuclear testing, increasing dependence upon modeling and experimentation with enhanced diagnostics and instrumentation to provide for continued stockpile confidence
- The continued emphasis on applying the resources and technologies developed within DOE national laboratories to improve the U.S. technological position and competitiveness
- The unique capabilities at LANL to support DOE's basic science mission

These factors will continue to influence DOE budget requests, management practices, and decisions. While future budget allocations cannot be predicted with accuracy, DOE is preparing for the future based on expressed national policies and the factors noted above. Thus, DOE expects that future demands on the unique capabilities at LANL are best addressed by the levels of operations described in the Expanded Operations Alternative, but at the 20 pits per year level.

It should be noted that the implementation of the 50 to 80 pits per year production capacity is more than 10 years into the future. While this level is the long-term goal, DOE's proposed action in the near term (next 10 years) is to achieve the 20 pits per year production level.

3.2.1 Plutonium Facility Complex

The Plutonium Facility Complex (TA–55) is described in chapter 2 (section 2.2.2.1). Under the Expanded Operations Alternative, the following activities would occur at this complex.

Plutonium Stabilization. LANL would recover, process, and store its existing plutonium residue inventory in 8 years.

Manufacturing Plutonium Components. LANL would produce up to 80 plutonium pits per year in multiple shift operations (up to 50 pits per year in single-shift operations). This would be implemented in a phased manner, with the near-term objective of establishing this capability at a 20 pits per year rate (Preferred Alternative). Under longer-term objectives, the 80 pits per year (using multiple shifts) capability would be established. In addition, LANL would fabricate parts and samples for research and development at a higher level than under the No Action Alternative (within the existing capacity of TA–55–4).

Surveillance and Disassembly of Weapons Components. LANL would continue to examine and disassemble plutonium pits, but the existing equipment and the responsibility for this activity would be moved to the CMR Building to make room for the expanded pit production capability needed at the Plutonium Facility. (A detailed analysis of the alternatives considered to address the need for additional space for pit production is included in the project-specific siting and construction [PSSC] analysis in the SWEIS, volume II. To bound the impact analysis, PSSC "CMR Building Use" Alternative, relocation of some activities to the CMR Building is assumed because it does not create new nuclear space.) This relocation would result in increased transportation between the Plutonium Facility and the CMR Building, causing increases in road closures (and increased inconvenience to motorists) or in increased packaging costs and risks to the public if U.S. Department of Transportation (DOT)-approved packaging without road closures is used. The DOE has included the environmental impacts to establish a dedicated road for transport between the Plutonium Facility and the CMR Building in the Expanded Operations Alternative. However, the road would not be constructed to establish the 20 pits per year capability (Preferred Alternative). Also, under the Preferred Alternative, the pit manufacturing process activities would not be moved to the CMR Building.

Actinide Materials Science and Processing Research and Development. Research would continue to be conducted on plutonium (and other actinide) materials, as described in chapter 2 (section 2.2.2.1) at a higher level than under the No Action Alternative (but within the existing capacity of TA–55–4). LANL would demonstrate the disassembly/conversion of plutonium pits as under the No Action Alternative and would also develop expanded disassembly capacity, processing up to 200 pits per year (including a total of 250 pits over 4 years as part of disposition demonstration activities) (DOE 1998). Up to 5,000 curies of neutron sources (plutonium-239/beryllium and americium-241/beryllium) would be processed at TA–55. Up to 880 pounds (400 kilograms) of actinides would be processed each year between

TA–55 and the CMR Building. LANL would also process neutron sources other than sealed sources. Although LANL would continue to process items through the Special Recovery Line (tritium separation), that activity would also move to the CMR Building to make room for the expanded pit production at the Plutonium Facility. LANL would perform oralloy decontamination of 28 to 48 uranium components per month in the TA–55 Plutonium Facility.

Research in support of DOE's actinide clean-up activities and on actinide processing and waste activities at DOE sites would be conducted at a level higher than that under the No Action Alternative. In addition, LANL would stabilize larger quantities of specialty items and residues from other DOE sites (including plutonium salts from the Rocky Flats Environmental Technology Site [RFETS]); fabricate and study larger amounts of nuclear fuels used in terrestrial and space reactors; fabricate and study larger amounts of prototype fuel for lead test assemblies; develop safeguards instrumentation for plutonium assay at a level increased from that of the No Action Alternative; and analyze samples. Half of the sample analysis would be conducted at the Plutonium Facility, with the remainder moved to the CMR Building (again, to make room for expanded pit production at the TA–55 Plutonium Facility).

Fabrication of Ceramic-Based Reactor Fuels. LANL would make prototype MOX fuel and would build test reactor fuel assemblies. LANL also would continue research and development on other fuels.

Plutonium-238 Research, Development, and Applications. LANL would process, evaluate, and test up to 55 pounds (25 kilograms) of plutonium-238 per year in production of materials and parts to support space and terrestrial uses. In addition, LANL would recover, recycle, and blend up to 40 pounds (18 kilograms) per year of plutonium-238.

Storage, Shipping, and Receiving. NMSF is to be renovated to perform as originally intended: to serve as a vault for the interim storage of up to 7.3 tons (6.6 metric tons) of the LANL SNM inventory, mainly plutonium. Storage, shipping, and receiving activities would be similar to those under the No Action Alternative, with the differences in shipping activity, as presented in volume III (appendix F, section F.5), increasing the amount of shipping and receiving activity (but not requiring a change in the storage capacity for TA–55).

Under all alternatives, the Plutonium Facility would be renovated to ensure the continued availability of existing capabilities, as described under the No Action Alternative, section 3.1.1. Under the Expanded Operations Alternative, additional upgrades would be performed to support newly assigned missions. Additional upgrades to support newly assigned missions under the Expanded Operations Alternative could include reconfiguration of interior space and installation of new equipment (see volume II, part II, for additional information on these upgrades) in support of expanded activities, as described above.

It is recognized that project plans change over time. If this alternative is selected, the construction projects proposed under this alternative as described above, would be reviewed prior to construction to determine whether additional NEPA analysis is required.

3.2.2 Tritium Facilities

The Tritium Facilities are described in chapter 2 (section 2.2.2.2). Under the Expanded Operations Alternative, the following activities would occur at these facilities.

High Pressure Gas Fills and Processing. LANL would handle and process tritium gas in quantities of up to 3.53 ounces (100 grams) at WETF approximately 65 times per year.

Gas Boost System Testing and Development. Approximately 35 times per year, LANL would conduct gas boost system research, development, and testing and gas processing operations at WETF involving quantities of up to 3.53 ounces (100 grams) of tritium.

Cryogenic Separation. At TSTA, LANL would purify and process tritium gas in quantities of up to 7.06 ounces (200 grams) approximately 5 to 6 times per year using cryogenic separation.

Diffusion and Membrane Purification. Significantly increasing from the No Action Alternative level, LANL would conduct research on tritium movement and penetration through materials including major experimental efforts approximately 6 to 8 times per month, accompanied by continuous use for effluent treatment.

Metallurgical and Material Research. LANL's metallurgical and materials research capability would be expanded above the No Action Alternative level, although the amount of tritium used would remain the same.

Thin Film Loading. LANL would use its thin film loading capability (involving chemically bonding tritium to a metallic surface) for tritium loading of neutron tube targets, processing approximately 3,000 units per year using small quantities of tritium.

Gas Analysis. LANL's activity to measure the composition and quantities of gases used would increase from the No Action Alternative level in support of increased tritium operations under this alternative.

Calorimetry. LANL's calorimetry measurements (a nondestructive method of measuring the amount of tritium in a container) would also increase from the No Action Alternative level in support of increased tritium operations under this alternative.

Solid Material and Container Storage. Tritium would continue to be stored on site in WETF, TSTA, and TSFF at approximately 10 times the amount to be stored under the No Action Alternative level.

Under all alternatives, LANL would remodel Building 16-450 and connect it to WETF in support of neutron tube target loading.

3.2.3 Chemistry and Metallurgy Research Building

The CMR Building is described in chapter 2 (section 2.2.2.3). Under the Expanded Operations Alternative, the following activities would occur at this facility.

Analytical Chemistry. LANL would provide expanded sample analysis in support of actinide research and processing activities, processing approximately 11,000 samples per year (including actinide sample analysis relocated from the Plutonium Facility).

Uranium Processing. LANL would conduct activities to recover, process, and store LANL's highly enriched uranium inventory over the next 8 years (same as No Action Alternative).

Destructive and Nondestructive Analysis. Up to 10 secondary assemblies per year would be evaluated through destructive and nondestructive analysis and disassembly.

Nonproliferation Training. LANL would also conduct more nonproliferation training using SNM than would be conducted under the No Action Alternative, and would possibly use different types of SNM in that training.

Actinide Research and Processing. LANL would process up to 5,000 curies of neutron sources (both plutonium-238/beryllium and americium-241/beryllium sources) per year at the CMR Building and would process neutron sources other than sealed sources. In addition, up to a total of 1,000 plutonium-238/beryllium and americium-241/beryllium neutron sources would be staged in CMR Building Wing 9 floor holes. LANL would begin a research and development effort on spent nuclear fuels related to long-term storage and would analyze materials from spent and partially spent fuels. Further, LANL would characterize approximately 100 samples per year using metallurgical microstructural/chemical analysis, would conduct compatibility testing of actinides and other metals in order to study long-term aging and other material effects, and would conduct research and development activities in hot cells on plutonium pits exposed to high temperatures. LANL would also conduct analysis of TRU waste disposal related to the validation of WIPP performance assessment models, characterize TRU waste, and analyze gas generation such as that which could occur during transportation to WIPP. Further, LANL would demonstrate decontamination technologies for actinide-contaminated soils and materials and develop an actinide precipitation method to reduce mixed wastes in LANL effluents.

Under the Expanded Operations Alternative, some actinide activities currently housed in the Plutonium Facility Complex (at TA–55) would move to the CMR Building to make room in TA–55–4 for increased plutonium pit production. Up to 400 kilograms of actinides would be processed per year between TA–55 and the CMR Building, and hydrodynamic testing and tritium separation activities would be supported at the CMR Building.

Fabrication and Metallography. LANL would produce 1,320 targets per year for production of molybdenum-99, with each target containing approximately 20 grams of uranium-235. LANL would separate fission products from the irradiated targets to provide molybdenum-99 (and other isotopes); this capability would produce up to 3,000 6-day curies of molybdenum-99 per week. (A 6-day curie is defined as the amount of product, in curies, remaining 6 days after the product is delivered to the radiopharmaceutical company.) In addition, LANL would retain the capability to fabricate metal shapes using highly enriched uranium (as well as the related uranium processing activities), with an annual throughput of approximately 2,200 pounds (1,000 kilograms).

Surveillance and Disassembly of Weapons Components. The CMR Building would also be used to disassemble approximately 65 plutonium pits per year (including 40 pits destructively examined). Up to 20 pits per year would be nondestructively examined, with additional testing conducted under the Expanded Operations Alternative (as compared to the No Action Alternative). This activity would move to the CMR Building from the TA–55 Plutonium Facility.

The Expanded Operations Alternative also includes the upgrades necessary to accommodate activities displaced from the Plutonium Facilities Complex to the CMR Building as a result of implementing enhanced pit fabrication. These upgrades are addressed in the PSSC analysis for the enhancement of plutonium pit manufacturing in this SWEIS, volume II.

In addition, under the Expanded Operations Alternative, modifications to CMR Building Wing 9 hot cells would be undertaken to provide for the safety testing of pits in a high-temperature environment (to assess the fire resistance of pits). These changes would place a glovebox and a furnace into one of the hot cells, as well as introduce additional instrumentation and equipment for controlling, monitoring and measuring such tests.

In addition, the four projects currently in development or implementation at the CMR Building are included in all alternatives as described under the No Action Alternative, section 3.1.3.

It is recognized that project plans change over time. If this alternative is selected, the construction projects proposed under this alternative (as described above), would be reviewed prior to construction to determine whether additional NEPA analysis is required.

3.2.4 Pajarito Site (Los Alamos Critical Experiments Facility)

The Pajarito Site is described in chapter 2 (section 2.2.2.4). Under the Expanded Operations Alternative, the following activities would occur at this facility.

LANL would continue to conduct experiments and tests in all of the areas described in section 2.2.2.4. These activities would increase by about 25 percent from the No Action Alternative levels of operation, and the nuclear materials inventory would increase by about 20 percent over No Action Alternative levels. As under the No Action Alternative, LANL would also develop safeguards instrumentation and perform research and development activities for SNM, light detection and ranging experiments, materials processing, interrogation techniques, and field systems.

3.2.5 Sigma Complex

The Sigma Complex is described in chapter 2 (section 2.2.2.5). Under the Expanded Operations Alternative, the following activities would occur at this complex.

Research and Development on Materials Fabrication, Coating, Joining, and Processing. Under the Expanded Operations Alternative, as under the No Action Alternative, LANL would continue to fabricate items from metals, ceramics, salts, beryllium, enriched uranium, depleted uranium, and other uranium isotope mixtures. Activities include casting, forming, machining, polishing, coating, and joining.

Characterization of Materials. LANL would continue research and development activities on properties of ceramics, oxides, silicides, composites, and high-temperature materials at a level slightly increased over that for the No Action Alternative. In addition, LANL would analyze up to 36 tritium reservoirs per year; and develop a library of aged non-SNM materials from stockpiled weapons and develop techniques to test and predict changes. Up to 2,500 non-SNM samples, including uranium, would be stored and characterized.

Fabrication of Metallic and Ceramic Items. LANL would, on an annual basis, fabricate stainless steel and beryllium components for approximately 80 plutonium pits, 200 reservoirs for tritium, components for up to 50 secondary assemblies (of depleted uranium, depleted uranium alloy, enriched uranium, deuterium, and lithium), nonnuclear components for research and development (50 to 100 major hydrotests and 50 joint test assemblies, beryllium targets at a slightly increased level over the No Action Alternative, targets and other components for accelerator production of tritium research, test storage containers for nuclear materials stabilization, and nonnuclear (stainless steel and beryllium) components for up to 20 plutonium pit rebuilds.

In addition, all of the alternatives include construction, renovation, and modification projects that are underway and planned in the near term for the purpose of maintaining the availability and viability of the Sigma Complex, as described under the No Action Alternative, section 3.1.5.

It is recognized that project plans change over time. If this alternative is selected, the construction projects proposed under this alternative (as described above), would be reviewed prior to construction to determine whether additional NEPA analysis is required.

3.2.6 Materials Science Laboratory

The MSL is described in chapter 2 (section 2.2.2.6). Under the Expanded Operations Alternative, the following activities would occur at this facility.

Materials Processing. LANL would maintain seven of eight materials processing activities at current levels of research; these activities are: wet chemistry, thermomechanical processing, microwave processing, heavy equipment materials, single crystal growth, amorphous alloys, and powder processing. LANL would expand its materials synthesis/processing activity to develop cold mock-up of weapons assembly and processing and to develop environmental and waste management technologies.

Mechanical Behavior in Extreme Environments. In addition, LANL would continue mechanical testing, fabrication, and assembly at current levels of research. Dynamic testing would be expanded to include research and development on the aging of weapons materials, and a new research capability in machining technology would be developed.

Advanced Materials Development. LANL would continue activities in materials, synthesis and characterization, ceramics, and superconductors at current levels of research.

Materials Characterization. LANL would also continue four of its six materials characterization activities at current levels of operation. These are: surface science chemistry, x-ray, optical metallography, and spectroscopy. Corrosion characterization would be expanded to develop surface modification technology and electron microscopy would be expanded to develop plasma source ion implantation.

3.2.7 Target Fabrication Facility

The Target Fabrication Facility is described in chapter 2 (section 2.2.2.7). Under the Expanded Operations Alternative, the following activities would occur at this facility.

Precision Machining and Target Fabrication. LANL would provide targets and specialized components for approximately 2,400 laser and physics tests per year, including a 10 to 20 percent annual growth in DoD and high explosives pulsed-power target operations for the next 10 years. This level of operations would include a 20 percent increase (over No Action Alternative levels) in high explosives pulsed-power target operations and approximately 100 high-energy density physics tests per year.

Polymer Synthesis. LANL would produce polymers for targets and specialized components for approximately 2,400 laser and physics tests per year, including a 10 to 20 percent annual growth in DoD and high explosives pulsed-power target operations for the next 10 years. This level of operations would include a 20 percent increase (over No Action Alternative levels) in high explosives pulsed-power target operations and approximately 100-high energy density physics tests per year.

Chemical and Physical Vapor Deposition. LANL would coat targets and specialized components for approximately 2,400 laser and physics tests per year, including a 10 to 20 percent annual growth in DoD and high explosives pulsed-power target operations for the next 10 years. This level of operations would include a 20 percent increase (over No Action Alternative levels) in high explosive pulsed-power target operations and approximately 100 high-energy density physics tests per year. This also would support plutonium pit manufacturing operations (as discussed in section 3.2.1).

3.2.8 Machine Shops

The Machine Shops are described in section 2.2.2.8. Under the Expanded Operations Alternative, the following activities would occur at these facilities.

The Machine Shops would provide fabrication support for the dynamic experiments program and explosive research studies, support up to 100 hydrodynamic tests annually, manufacture 50 joint test assembly sets annually, and provide general laboratory fabrication support as requested. LANL would also continue its fabrication activities using unique and unusual materials and provide appropriate dimensional inspection of these activities at a level up to 3 times that of the No Action Alternative. In addition, LANL would undertake additional types of measurements and inspections in its dimensional inspection of fabricated components.

3.2.9 High Explosives Processing Facilities

The High Explosives Processing Facilities are described in chapter 2 (section 2.2.2.9). Activities under this alternative would require an estimated 82,700 pounds (37,500 kilograms) of explosives and 2,910 pounds (1,320 kilograms) of mock explosives annually (this is an indicator of overall activity levels in this key facility). Under the Expanded Operations Alternative, the following activities would occur at these facilities.

High Explosives Synthesis and Production. LANL would increase by 50 percent over the No Action Alternative level of high explosives synthesis and production research and development, produce new materials, and formulate plastic-bonded explosives as needed. Process development would increase over the No Action Alternative level and materials would be produced for research and stockpile applications.

High Explosives and Plastics Development and Characterization. LANL would evaluate stockpile returns and increase by 40 percent (over No Action Alternative levels) efforts in development and characterization of new plastics and high explosives for stockpile improvement. LANL would also increase its efforts to improve its predictive capabilities and conduct research into high explosives waste treatment methods over No Action Alternative levels.

High Explosives and Plastics Fabrication. LANL would increase its stockpile surveillance and process development by 40 percent and double the supply of parts to Pantex for surveillance and WR rebuilds and joint test assemblies over No Action Alternative levels. Fabrication for hydrodynamic and environmental testing would be increased by 50 percent over No Action Alternative levels.

Test Device Assembly. Operations would be increased over current levels to support stockpile related hydrodynamic tests, joint test assemblies, environmental and safety tests, and research and development activities. Approximately 100 major hydrodynamic test device assemblies would be supported annually.

Safety and Mechanical Testing. Safety and environmental testing related to stockpile assurance would be increased by 50 percent over No Action Alternative levels and predictive models would be improved. Approximately 15 safety and mechanical tests would be conducted annually.

Research, Development, and Fabrication of High-Power Detonators. LANL would increase efforts to support SSM activities, manufacture up to 40 major product lines per year, and support DOE-wide packaging and transportation of electro-explosive devices.

3.2.10 High Explosives Testing

High explosives testing is described in section 2.2.2.10. This alternative includes about 1,800 experiments per year, 100 of which would be characterized as major hydrodynamic tests. In addition to smaller quantities of other materials, up to 6,900 pounds (3,130 kilograms) of depleted uranium would be expended in experiments annually. As these numbers indicate, overall high explosives test activity would be about three times that under the No Action Alternative. Under the Expanded Operations Alternative, the following activities would occur.

Hydrodynamic Tests. LANL would increase the number of hydrodynamic tests (over the No Action Alternative), develop containment technology, and conduct tests of weapons configurations. These would include up to 100 major hydrodynamic tests per year.

Dynamic Experiments. LANL would increase these experiments by approximately 50 percent (over No Action Alternative levels) the number of dynamic experiments to study properties and enhance understanding of the basic physics of state and motion for materials used in nuclear weapons, including some experiments with SNMs.

Explosives Research and Testing. Up to twice as many high explosives tests would be conducted as under the No Action Alternative to characterize explosive materials.

Munitions Experiments. As under the No Action Alternative, LANL would continue to support DoD in conventional munitions, conducting experiments with projectiles and studying other effects of munitions.

High Explosives Pulsed-Power Experiments. LANL would conduct up to twice as many high explosives pulsed-power experiments and development tests.

Calibration, Development, and Maintenance Testing. LANL would conduct up to twice as many tests to provide calibration data, instrumentation development, and maintenance of image processing capability.

Other Explosives Testing. LANL would conduct 50 percent more advanced high explosives or weapons evaluation studies than under the No Action Alternative.

The operation of the DARHT facility is included in all alternatives.

3.2.11 Los Alamos Neutron Science Center

LANSCE is described in chapter 2 (section 2.2.2.11). Under the Expanded Operations Alternative, the following activities would occur at this facility.

Accelerator Beam Delivery, Maintenance, and Development. LANSCE would deliver a linear accelerator beam to Areas A, B, and C; the WNR buildings; the Manuel Lujan Center; the dynamic test facility; and a new Isotope Production Facility for 10 months each year (6,400 hours). The H^+ beam current would be 1,250 microamps and the H^- beam current would be 200 microamps. The beam delivery and support equipment would be reconfigured to support new facilities, upgrades, and experiments.

A 40-million electron volt LEDA would be built and operated in an existing facility (TA–53–365) for 10 to 15 years, operating up to approximately 6,600 hours per year, as described under the No Action Alternative, section 3.1.11.

Experimental Area Support. Support activities would continue, consistent with the levels of operation under this alternative (same activities as those described under the No Action Alternative). Remote handling and packaging of radioactive materials and wastes at LANSCE would increase to handle waste generation that results from the facility construction and modifications at LANSCE under this alternative (as discussed later in this section).

Neutron Research and Technology. LANL would conduct 1,000 to 2,000 different experiments annually, using neutrons from the Manuel Lujan Center, WNR, and the Long-Pulse Spallation Source (LPSS). The LPSS would be a new experimental facility that would provide advanced capabilities for neutron scattering and subatomic physics using cold and ultracold neutrons. Together with the SPSS at the Manuel Lujan Center, the LPSS would provide U.S. scientists with a complementary pair of neutron sources for research in materials, biological, and nuclear science.

The LPSS neutron production system, which would be located in Area A, would consist of a tungsten target, moderators, and a reflector surrounded by a large iron and concrete biological shield. The Area A building has 100,000 square feet (9,300 square meters) of space and a usable height of 45 feet (14 meters). No modifications would be required to the building or floor of Area A, but existing experimental stations and other equipment in Area A would have to be dismantled and removed, including Area A experimental stations, the Neutrino Scintillation Detector Station, and Area A shielding. This removal of existing experimental stations, instrumentation, and related hardware would generate an estimated 118,000 cubic feet (3,300 cubic meters) of suspect contaminated concrete that would be disposed at TA–54/Area G (8,400 tons [7,620 metric tons], 420 shipments), and another 48,000 cubic feet (1,350 cubic meters) of activated metals and debris (for which 200 Type B cask shipments would be required, and 900 low specific activity and Type A shipments, all to TA–54).

As part of the LPSS project, the linear accelerator would be upgraded to deliver an average proton current of 1.25 milliampere (versus 1.0 at present), for a power of 1.0 megawatt (versus 0.8 at present). This upgrade would increase LANSCE electricity and cooling water requirements.

The LPSS design would use an evacuated target cell that would largely eliminate short-lived activation products. This newer design would decrease radioactive air emissions by an order of magnitude (per unit basis of microampere-hours of linear accelerator operation). This design would result in LPSS operations contributing no more than 1 millirem per year to the dose received by the maximally exposed individual defined for LANSCE. (The term “maximally exposed individual” is discussed in the Air Quality sections of chapters 4 and 5).

The LPSS target, moderators, and hot cell would be constructed inside Building 53–003M, and would thus require no additional land disturbance. There would be no change from the current industrial use of these disturbed areas.

LANL also would construct and operate a Dynamic Experiment Laboratory (DEL) to provide both neutron and proton radiography and resonance neutron spectroscopy of materials for the study of dynamic materials phenomena under a single roof. Such techniques are currently employed for experiments at LANSCE but in varying locations; they complement x-ray radiographic and other techniques for dynamic materials studies used at LANL and other DOE facilities. The DEL also would provide improved support for these experiments and some added capabilities. It would provide more effectively utilized physical space and dedicated infrastructure for these experiments; it would enable proton radiography experiments to use beam from the Proton Storage Ring, thereby reducing interference of these experiments with other LANSCE uses and increasing the beam intensity available for proton radiography; and it would incorporate gas guns to enable additional shock wave experiments and simplify some such experiments. The DEL would be constructed as a new facility adjacent to WNR. It would make use of existing LANSCE infrastructure, including the 800-million electron volt linear accelerator, the Proton Storage Ring, and existing personnel.

The proton radiography experimental program requires a containment vessel, beam tubes in the upstream and downstream lenses, three beam axes with two matching lenses and two downstream lenses on each axis, and a gas gun pointing at the center of the containment vessel. The resonance neutron spectroscopy and neutron radiography experiments require a neutron production target and moderator, a flight path about 66 feet (20 meters) in length, and a gas gun pointing at the center of the containment vessel.

A high explosives assembly area and magazine would be attached to the outside of DEL, with an explosion-proof door separating the two. Separate from DEL with its high explosives areas, a counting house and a building for support equipment (e.g., power supplies, deionized water system) would be needed. This laboratory would be established in a previously disturbed area. There would be no change from the current industrial use of these areas.

LANL would also conduct an accelerator production of tritium target neutronics experiment for 6 months. In addition, LANL would continue to support contained weapons-related experiments using small to moderate quantities of high explosives. These experiments would include:

- Experiments with nonhazardous materials and small quantities of high explosives (up to approximately 200 per year)
- Experiments with up to 10 pounds (4.54 kilograms) of high explosives and/or depleted uranium (up to approximately 60 per year)
- Experiments with small quantities of actinides, high explosives, and sources (up to approximately 80 per year)
- Shockwave experiments involving small amounts, up to nominally 1.8 ounces (50 grams), of plutonium

In addition, LANL would provide support for static stockpile surveillance technology research and development.

Accelerator-Driven Transmutation Technology. LANL would conduct lead target tests for 2 years at the Area A beam stop, as well as the 1 megawatt target/blanket experiments, as described in section 3.1.11. Once these experiments were completed, LANL would construct a 5-megawatt target/blanket experimental area (referred to as the Los Alamos International Facility for Transmutation [LIFT]) adjacent to Area A, and conduct 5-megawatt experiments for 10 months per year for 4 years.

LIFT would be used to demonstrate the practicality of using accelerator technology to transmute plutonium and high-level radioactive wastes into other elements or isotopes. LIFT would be constructed adjacent to Area A in a previously disturbed area. There would be no change from the current industrial use of these areas.

Subatomic Physics Research. LANL would conduct five to ten physics experiments annually at the Manuel Lujan Center, WNR, and LPSS and conduct proton radiography experiments. Proton radiography experiments would include contained experiments using small to moderate quantities of high explosives similar to those discussed above under Neutron Research and Technology.

Medical Isotope Production. Up to approximately 50 targets per year would be irradiated for medical isotope production and exotic and neutron rich/deficient isotopes would be produced.

In addition, LANL would establish the Exotic Isotope Production Facility in an existing facility, which would complement the 100-million electron volt IPF by using the 800-million electron volt proton beam available at the end of the half-mile-long linear accelerator to fabricate radioisotopes used by the medical community for diagnostic and other procedures. This facility would be established within an existing building and would not result in either land disturbance or a change from the current industrial land use of these areas.

Also under the Expanded Operations Alternative, Area A East would be stripped of existing contaminated and uncontaminated items so that it could be put to use as a staging area for shipments, receipts, equipment storage, and limited maintenance activities. (This portion of Experimental Area A currently houses a beam stop, shielding, and equipment related to isotope production and materials irradiation activities.) Removal of existing items would generate wastes for disposal, including an estimated 50,000 cubic feet (1,400 cubic meters) of suspect contaminated concrete, 20,000 cubic feet (560 cubic meters) of activated metal used for shielding, and another 14,000 cubic feet (400 cubic meters) of equipment and debris. Wastes would total an estimated 1,700 tons (1,540 metric tons), the disposal of which would require 200 Type B cask shipments, 530 Type A shipments, and 290 low specific activity shipments, all to TA–54.

High-Power Microwaves and Advanced Accelerators. Research and development in this area would be conducted at the same levels described under the No Action Alternative.

Under all alternatives, the following facilities (as described under the No Action Alternative, section 3.1.11 and in chapter 2, section 2.2.2.11) would be constructed and operated (based on previous NEPA reviews):

- LEDA
- Proton radiography and neutron spectroscopy facilities
- IPF relocation
- SPSS enhancement

It is recognized that project plans change over time. If this alternative is selected, the construction projects proposed under this alternative (as described above), would be reviewed prior to construction to determine whether additional NEPA analysis is required.

3.2.12 Health Research Laboratory

The HRL is described in chapter 2 (section 2.2.2.12). Under the Expanded Operations Alternative, the following activities would occur at this facility.

Genomic Studies. LANL would increase genomic studies at HRL by approximately 25 percent over the No Action Alternative level.

Cell Biology. LANL would increase its research activities by approximately 40 percent above the No Action Alternative level.

Cytometry. LANL's research utilizing laser imaging systems to analyze the structures and functions of subcellular systems would increase by approximately 33 percent.

DNA Damage and Repair. Research using isolated cells to investigate DNA repair mechanisms would increase by approximately 40 percent above the No Action Alternative levels.

Environmental Effects. LANL would conduct research that identifies specific changes in DNA and proteins in certain microorganisms that occur after events in the environment at a level approximately 25 percent higher than the No Action Alternative.

Structural Cell Biology. LANL would conduct research utilizing chemical and crystallographic techniques to isolate and characterize the three-dimensional shapes and properties of DNA and protein molecules at a level approximately 50 percent higher than the No Action Alternative.

Neurobiology. LANL's activities in neurobiology, conducting research using magnetic fields produced in active areas of the brain to map human brain locations associated with certain sensory and cognitive functions, would be increased to three times that of the No Action Alternative.

In-Vivo Monitoring. LANL would conduct 3,000 whole-body scans annually as a service that supports operations with radioactive materials conducted elsewhere at LANL.

3.2.13 Radiochemistry Facility

The Radiochemistry Facility is described in chapter 2 (section 2.2.2.13). As an indicator of overall activity levels, these operations would be expected to require about 250 FTEs. Under the Expanded Operations Alternative, the following activities would occur at this facility.

Radionuclide Transport. LANL would conduct 80 to 160 of these studies annually.

Environmental Remediation. Environmental remediation activities would approximately double the No Action Alternative level of operations.

Ultra-Low-Level Measurements. These activities would be at approximately double the No Action Alternative level.

Nuclear/Radiochemistry. These operations would be slightly more than the No Action Alternative levels.

Isotope Production. LANL would conduct target preparation, irradiation, and processing to recover medical and industrial application isotopes at a level approximately double that of the No Action Alternative.

Actinide/Transuranic Chemistry. LANL would also perform radiochemical separations at approximately twice the No Action Alternative level of operations.

Data Analysis. LANL would reexamine archive data and measure nuclear process parameters of interest to weapons radiochemists at approximately twice the No Action Alternative level.

Inorganic Chemistry. LANL would conduct synthesis, catalysis, and actinide chemistry activities at a level approximately 50 percent higher than that of the No Action Alternative.

Structural Analysis. LANL would perform these activities at approximately twice the No Action Alternative level of operation.

Sample Counting. LANL's sample counting activity would be the same as the No Action Alternative.

3.2.14 Radioactive Liquid Waste Treatment Facility

The RLWTF is described in chapter 2 (section 2.2.2.14). Under the Expanded Operations Alternative, the following activities would occur at this facility.

Waste Characterization, Packaging, and Labeling. Under this alternative, as under the No Action Alternative, LANL would support, certify, and audit generator characterization programs and maintain the WAC for the RLWTF.

Waste Transport, Receipt, and Acceptance. LANL would also collect radioactive liquid waste from generators and transport it to the RLWTF in TA–50.

Radioactive Liquid Waste Pretreatment. LANL would pretreat 238,000 gallons (900,000 liters) of RLW per year at TA–21; 21,100 gallons (80,000 liters) of RLW per year at TA–50; and solidify, characterize, and package 106 cubic feet (3 cubic meters) of TRU waste sludge per year at TA–50.

Radioactive Liquid Waste Treatment. LANL would install equipment for nitrate reduction in mid 1999, treat 9.24 million gallons (35 million liters) of RLW per year; dewater, characterize, and package 353 cubic feet (10 cubic meters) of LLW sludge per year; and solidify, characterize, and package 1,130 cubic feet (32 cubic meters) of TRU waste sludge per year.

Decontamination Operations. LANL would:

- Decontaminate personnel respirators for reuse (approximately 700 per month).
- Decontaminate air-proportional probes for reuse (approximately 300 per month).
- Decontaminate vehicles and portable instruments for reuse (as required).
- Decontaminate precious metals for resale (acid bath).
- Decontaminate scrap metals for resale (sand blast).
- Decontaminate 7,060 cubic feet (200 cubic meters) of lead for reuse (grit blast).

Three modifications were recently completed or are planned for the RLWTF: an upgrade to the influent tank system, installation of a new process for treatment of RLW, and installation of additional treatment steps for removal of nitrates. These have all been previously reviewed under NEPA and are included in all of the SWEIS alternatives as described under the No Action Alternative, section 3.1.14, and in chapter 2, section 2.2.2.14.

3.2.15 Solid Radioactive and Chemical Waste Facilities

The Solid Radioactive and Chemical Waste Facilities are described in chapter 2 (section 2.2.2.15). Under the Expanded Operations Alternative, the following activities would occur at these facilities.

Waste Characterization, Packaging, and Labeling. Under this alternative, as under the No Action Alternative, LANL would support, certify, and audit generator characterization programs and maintain the WAC for LANL waste management facilities. At the Solid Radioactive and Chemical Waste Facilities, LANL would characterize 26,800 cubic feet (760 cubic meters) of legacy LLMW; characterize 318,000 cubic feet (9,010 cubic meters) of legacy TRU waste; verify characterization data at the RANT Facility, for unopened containers of LLW and TRU waste; maintain the WAC for off-site treatment, storage, and disposal facilities; and overpack and bulk waste containers.

As under the No Action Alternative, LANL would also perform coring and visual inspection of a percentage of TRU waste packages, ventilate 16,700 drums of TRU waste retrieved during the TWISP, and maintain the current version of the WIPP WAC and coordinate with WIPP operations.

Compaction. LANL would compact up to 896,600 cubic feet (25,400 cubic meters) of LLW.

Size Reduction. In addition, 102,400 cubic feet (2,900 cubic meters) of TRU waste would be reduced in size at the WCRR Facility in TA–50 and the Drum Preparation Facility in TA–54.

Waste Transport, Receipt, and Acceptance. LANL would collect chemical and mixed wastes from LANL generators and transport them to TA–54. LANL would ship 35,260 tons (32,000 metric tons) of chemical wastes and

128,500 cubic feet (3,640 cubic meters) of LLMW for off-site treatment and disposal in accordance with EPA land disposal restrictions. Beginning in 1999, 318,000 cubic feet (9,010 cubic meters) of legacy TRU waste would be shipped to WIPP. LANL would also ship 192,700 cubic feet (5,460 cubic meters) of TRU waste generated as a result of future operations and research to WIPP. LANL would not ship LLW or environmental restoration soils for off-site disposal.

Waste Storage. As under the No Action Alternative, prior to shipment to off-site treatment, storage, and disposal facilities, LANL would store chemical and mixed wastes. LANL would also store legacy TRU waste until WIPP is opened for disposal; LLMW until treatment facilities are available; and LLW uranium chips until sufficient quantities were accumulated for stabilization campaigns.

Waste Retrieval. LANL would retrieve 165,900 cubic feet (4,700 cubic meters) of TRU waste from Pads 1, 2, and 4 by 2004 (same level as the No Action Alternative).

Other Waste Processing. LANL would demonstrate treatment (e.g., electrochemical) of LLMW liquids, land farm oil-contaminated soils at Area J, stabilize 30,700 cubic feet (870 cubic meters) of uranium chips, provide special case treatment for 36,360 cubic feet (1,030 cubic meters) of TRU waste, and solidify 100,600 cubic feet (2,850 cubic meters) of LLMW (environmental restoration soils) for disposal at Area G.

Disposal. LANL would dispose of 14,830 cubic feet (420 cubic meters) of LLW in shafts at Area G, 4,060,000 cubic feet (115,000 cubic meters) of LLW and small quantities of radioactively contaminated PCBs in disposal cells at Area G, approximately 3,530 cubic feet (100 cubic meters) of administratively controlled industrial solid wastes in cells at Area J annually, and nonradiological classified wastes in shafts at Area J. In addition, LLW disposal operations in Area G would be expanded.

Existing disposal capacity is projected to be filled before 2000. Under the Expanded Operations Alternative, Area G would be expanded to allow continued disposal of LLW at LANL. Five siting and construction alternatives for expanded disposal operations are discussed in the PSSC analysis for Expansion of TA–54/Area G Low-Level Disposal Area in the SWEIS, volume II, part I. Expansion into Zones 4 and 6 in Area G is identified as DOE's preferred expansion alternative in that analysis.

In addition, under all alternatives, LANL would construct storage domes for TRU wastes recovered from Pads 1, 2, and 4. This is described under the No Action Alternative, section 3.1.15.

It is recognized that project plans change over time. If this alternative is selected, the construction projects proposed under this alternative would be reviewed prior to construction to determine whether additional NEPA analysis is required.

3.3 REDUCED OPERATIONS ALTERNATIVE

The Reduced Operations Alternative reflects minimum levels of activity to maintain the capabilities necessary to support LANL's assigned missions. This activity level is a projection from the index established for past operations and represents a level that is possible if funding is reduced. In some cases, the selected index was the best available for most operations at LANL, but could not reasonably be adjusted from the historical record to account for capabilities insufficiently exercised during that period. In those cases, the Reduced Operations activity may reflect an increase over the index (although no greater than that under the No Action Alternative).

This alternative does not eliminate assigned missions or programs, but results in reduced technology demonstration activities and/or a decline in technological capability. In the long term, implementation of the Reduced Operations Alternative could reduce LANL capabilities below those required to fully meet its existing assigned missions.

For this alternative, LANL operations would be reduced to the minimum necessary to maintain safety and security activities such as the maintenance of nuclear materials, high explosives, or other hazardous materials in storage or use at LANL. Under this alternative, for example, plutonium processing activities would be reduced, but would occur at a level that could still support the safe, secure maintenance of the plutonium inventory.

Construction (including facility modification) projects that are required to maintain LANL activities, even at a reduced level, are included in this alternative. Some construction projects also may be required to support consolidation of some operations to fewer facilities or within a currently used facility, resulting in a reduced "footprint." These construction and upgrade activities are identified in the descriptions of activities under this alternative for each of the key facilities. This SWEIS constitutes the entire NEPA review for these projects.

3.3.1 Plutonium Facility Complex

The Plutonium Facility Complex (TA–55) is described in chapter 2 (section 2.2.2.1). Under the Reduced Operations Alternative, the following activities would occur at this complex.

Plutonium Stabilization. LANL would recover, process, and store its existing plutonium residue inventory in 10 to 15 years.

Manufacturing Plutonium Components. LANL would produce 6 to 12 plutonium pits per year in order to maintain the technical capability to understand pit characteristics and behavior. In addition, it would fabricate other parts and samples for research and development at the same levels as under the No Action Alternative.

Surveillance and Disassembly of Weapons Components. As under the No Action Alternative, LANL would disassemble up to 40 plutonium pits per year (including up to 20 pits destructively examined). Up to 20 pits would be nondestructively examined.

Actinide Materials Science and Processing Research and Development. As under the No Action Alternative, LANL would continue to conduct research on plutonium (and other actinide) materials. The types and levels of these activities are the same under this alternative as under the No Action Alternative. LANL would demonstrate the disassembly/ conversion of 1 to 2 pits per day (up to 40 pits total) using hydride-dehydride processes. Up to 500 curies of neutron sources (plutonium-239/ beryllium and americium-241/beryllium) would be processed to maintain capability; LANL would retain the capability to process actinides and undertake tritium separation from metals, but would not use these capabilities. LANL would perform decontamination of 15 to 20 uranium components per month.

Research in support of DOE's actinide clean-up activities and on actinide processing and waste activities at DOE sites would be conducted, although support to other sites would be less than under the No Action Alternative. As under the No Action Alternative, LANL would stabilize minor quantities of specialty items and residues from other DOE sites; fabricate and study small amounts of nuclear fuels used in terrestrial and space reactors; fabricate and study prototype fuel for lead test assemblies; continue to develop safeguards instrumentation for plutonium assay; and analyze samples.

Fabrication of Ceramic-Based Reactor Fuels. LANL would conduct MOX and other fuel research and development.

Plutonium-238 Research, Development, and Applications. LANL would process, evaluate, and test up to 15.4 pounds (7 kilograms) of plutonium-238 per year in production of materials and parts to support space and terrestrial uses. In addition, up to 1.1 pounds (0.5 kilograms) of plutonium-238 per year would be processed to recover material from heat sources and milliwatt generators, research and development, and safety testing.

Storage, Shipping, and Receiving. The NMSF is to be renovated to perform as originally intended: to serve as a vault for the interim storage of up to 7.3 tons (6.6 metric tons) of the LANL SNM inventory, mainly plutonium. The NMSF renovation is included in all alternatives.

Under all alternatives, the Plutonium Facility would be renovated to ensure the continued availability of existing capabilities as described under the No Action Alternative, section 3.1.1.

It is recognized that project plans change over time. If this alternative is selected, the construction projects proposed under this alternative (as described above), would be reviewed prior to construction to determine whether additional NEPA analysis is required.

3.3.2 Tritium Facilities

The Tritium Facilities are described in chapter 2 (section 2.2.2.2). Under the Reduced Operations Alternative, the following activities would occur at these facilities.

High-Pressure Gas Fills and Processing. LANL would handle and process tritium gas in quantities of up to 3.53 ounces (100 grams) at the WETF approximately 20 times per year.

Gas Boost System Testing and Development. Approximately 15 times per year, LANL would conduct gas boost system research, development, and testing and gas processing operations at WETF involving quantities of up to 100 grams of tritium.

Cryogenic Separation. At TSTA, LANL would purify and process tritium gas in quantities of up to 7.06 ounces (200 grams) once per year using cryogenic separation.

Diffusion and Membrane Purification. LANL would conduct research on tritium movement and penetration through materials including major experimental efforts approximately 2 to 3 times per month.

Metallurgical and Material Research. LANL would also conduct metallurgical and materials research involving tritium including research and application studies regarding tritium storage (same as the No Action Alternative).

Thin Film Loading. In addition, LANL would use its thin film loading capability (involving chemically bonding tritium to a metallic surface) for tritium loading of neutron tube targets, processing approximately 800 units per year (same as the No Action Alternative).

Gas Analysis. LANL's activities to measure the composition and quantities of gases used would continue in support of tritium operations.

Calorimetry. LANL's calorimetry measurements (a nondestructive method of measuring the amount of tritium in a container) would also continue in support of tritium operations.

Solid Material and Container Storage. Tritium would continue to be stored on site in WETF, TSTA, and TSFF.

Under all alternatives, LANL would remodel Building 16-450 and connect it to WETF in support of neutron tube target loading.

3.3.3 Chemistry and Metallurgy Research Building

The CMR Building is described in chapter 2 (section 2.2.2.3). Under the Reduced

Operations Alternative, the following activities would occur at this facility.

Analytical Chemistry. LANL would provide sample analysis in support of actinide research and processing activities, processing approximately 5,200 samples per year (same as the No Action Alternative).

Uranium Processing. LANL would conduct activities to recover, process, and store LANL's highly enriched uranium inventory over the next 10 to 15 years.

Destructive and Nondestructive Analysis. Up to a total of 10 secondary assemblies (1 per year) would be evaluated through destructive and nondestructive analysis and disassembly (same as the No Action Alternative).

Nonproliferation Training. Reducing from the No Action Alternative level, LANL would also conduct some nonproliferation training using the same quantities of SNM as under the No Action Alternative.

Actinide Research and Processing. LANL would maintain its capabilities for plutonium-238/beryllium and americium-241/beryllium neutron source processing, but annual throughput would not exceed a total of 2,000 curies at the CMR Building. In addition, up to a total of 1,000 plutonium-238/beryllium and neutron sources would be staged in CMR Building Wing 9 floor holes. LANL would retain its capability for research and development activities on spent nuclear fuels. Further, LANL would characterize approximately 25 samples per year using metallurgical microstructural/chemical analysis and would conduct compatibility testing of actinides and other metals in order to study long-term aging and other material effects. LANL would also conduct analysis of TRU waste disposal related to the validation of WIPP performance assessment models, characterize TRU waste, and analyze gas generation such as that which could occur during transportation to WIPP.

Fabrication and Metallography. LANL would produce 50 targets per year for production of molybdenum-99, with each target containing approximately 0.71 ounces (20 grams) of uranium-235. The targets would be stored. In addition, LANL would support highly enriched uranium processing, research and development, pilot operations, and casting and fabrication of metal shapes using from 2.2 to 22 pounds (1 to 10 kilograms) of highly enriched uranium in each operation, with an annual throughput of approximately 2,200 pounds (1,000 kilograms) (which would remain in the LANL material inventory).

In addition, the four projects currently in development or implementation at the CMR Building are included in all alternatives, as described under the No Action Alternative, section 3.1.3.

3.3.4 Pajarito Site (Los Alamos Critical Experiments Facility)

The Pajarito Site is described in chapter 2 (section 2.2.2.4). Under the Reduced Operations Alternative, the following activities would occur at this facility.

Under the Reduced Operations Alternative as under the No Action Alternative, LANL would continue to conduct experiments and tests in all of the areas described in section 2.2.2.4. In 1997, as with the No Action Alternative, up to 570 experimental operations would be expected, with a 5 percent annual growth after that. LANL would also develop safeguards instrumentation and perform research and development activities for SNM, light detection and ranging experiments, materials processing, interrogation techniques, and field systems.

3.3.5 Sigma Complex

The Sigma Complex is described in section 2.2.2.5. The Reduced Operations Alternative for the Sigma Complex is the same as the No Action Alternative, as described in section 3.1.5.

3.3.6 Materials Science Laboratory

The MSL is described in section 2.2.2.6. Under the Reduced Operations Alternative, the following activities would occur at this facility.

Materials Processing. LANL would continue materials processing research at the MSL; these capabilities are: synthesis and processing techniques, wet chemistry, thermomechanical processing, microwave processing, heavy equipment materials, single crystal growth, amorphous alloys, and powder processing. However, there would be a decrease in the number of experiments conducted in these research capabilities as compared to the No Action Alternative.

Mechanical Behavior in Extreme Environments. LANL would continue mechanical testing, dynamic testing, and fabrication and assembly research, although there would be a decrease in the number of experiments conducted, as compared to the No Action Alternative.

Advanced Materials Development. LANL would continue research into materials, synthesis and characterization, ceramics, and superconductors activities, although there would be a significant decrease in the number of experiments conducted, as compared to the No Action Alternative.

Materials Characterization. LANL would also continue two of its materials characterization activities (surface science chemistry and corrosion characterization), although there would be a decrease in the number of experiments conducted, as compared to the No Action Alternative. Electron microscopy, x-ray, optical metallography, and spectroscopy capabilities would be eliminated.

3.3.7 Target Fabrication Facility

The TFF is described in chapter 2 (section 2.2.2.7). Under the Reduced Operations Alternative, the following activities would occur at this facility.

Precision Machining and Target Fabrication. LANL would provide targets and specialized components for approximately 400 laser and high-energy density physics tests per year.

Polymer Synthesis. LANL would produce polymers for targets and specialized components for approximately 400 laser and high-energy density physics tests per year.

Chemical and Physical Vapor Deposition. LANL would coat targets and specialized components for approximately 400 laser and high-energy density physics tests per year. Support for pit manufacturing operations would be the same as under the No Action Alternative.

3.3.8 Machine Shops

The Machine Shops are described in section 2.2.2.8. Under the Reduced Operations Alternative, the following activities would occur at these facilities.

The Machine Shops would provide fabrication support for the dynamic experiments program and explosive research studies, support up to 30 hydrodynamic tests annually, manufacture 20 to 40 joint test assembly sets annually, and provide general laboratory fabrication support as requested. LANL would also continue its fabrication activities using unique and unusual materials and provide appropriate dimensional inspection of these activities. (These activity levels are about the same as under the No Action Alternative.)

3.3.9 High Explosives Processing Facilities

The High Explosives Processing Facilities are described in section 2.2.2.9. Under this alternative, 19,400 pounds (8,800 kilograms) of explosives and 1,150 pounds (520 kilograms) of mock explosives would be used annually (as an indicator of overall activity levels in this key facility). Under the Reduced Operations Alternative, the following activities would occur at these facilities.

High Explosives Synthesis and Production. LANL would reduce its current level of high explosives synthesis and production research and development, production of new materials and formulation of plastic-bonded explosives by approximately 60 percent. Process development would decrease from current levels, and materials production for research and stockpile applications would continue at a reduced level (approximately 60 percent of the No Action Alternative).

High Explosives and Plastics Development and Characterization. LANL would evaluate stockpile returns and decrease efforts in development and characterization of new plastics and high explosives for stockpile improvement. LANL would also conduct research into high explosives waste treatment methods, with the overall level of effort reduced to about 60 percent of the No Action Alternative.

High Explosives and Plastics Fabrication. LANL would reduce its traditional stockpile surveillance and process development from No Action Alternative levels by approximately 60 percent. Stockpile surveillance fabrication for hydrodynamic and environmental testing would be reduced to approximately 75 percent of the No Action Alternative levels.

Test Device Assembly. Operations would be the same as the No Action Alternative levels. Approximately 30 major hydrodynamic test devices would be assembled annually.

Safety and Mechanical Testing. Safety and environmental testing related to stockpile assurance would be reduced to approximately 80 percent of No Action Alternative levels, and predictive models would be improved. Approximately 12 safety and mechanical tests would be conducted annually.

Research, Development, and Fabrication of High-Power Detonators. As with the No Action Alternative, LANL would manufacture up to 20 major product lines per year and support DOE-wide packaging and transportation of electro-explosive devices.

3.3.10 High Explosives Testing

High explosives testing is described in chapter 2 (section 2.2.2.10). The Reduced Operations Alternative for LANL's high explosives testing facilities is the same as the No Action Alternative, as described in section 3.1.10.

3.3.11 Los Alamos Neutron Science Center

The LANSCE is described in section 2.2.2.11. Under the Reduced Operations Alternative, the following activities would occur at this facility.

Accelerator Beam Delivery, Maintenance, and Development. LANSCE would deliver a linear accelerator beam to Areas A, B, and C; WNR buildings; the Manuel Lujan Center; radiography firing sites; and a new IPF for 4 months each year (2,600 hours). The H^+ beam current would be 1,000 microamps and the H^- beam current would be 200 microamps. The beam delivery and support equipment would be reconfigured to support new facilities, upgrades, and experiments.

Under the Reduced Alternative, the LEDA would be operated at 12-million electron volts to demonstrate the practicality of using continuous-wave accelerator beam technology to produce tritium, as an alternative to the historical use of nuclear reactors. It would operate for 2 years, operating up to approximately 1,000 hours per year. This facility would be constructed as described under the No Action Alternative, section 3.1.11.

Experimental Area Support. The same support activities would continue at the same levels as described under the No Action Alternative. Remote handling and packaging of radioactive wastes at LANSCE would be maintained at fiscal year 1994 levels.

Neutron Research and Technology. LANL would conduct 100 to 500 different experiments annually, using neutrons from Manuel Lujan Center and WNR. LANL would continue to support contained weapons-related experiments using small to moderate quantities of high explosives. These experiments would include:

- Experiments with nonhazardous materials and small quantities of high explosives (up to approximately 50 per year)
- Experiments with up to 10 pounds (4.54 kilograms) of high explosives and/or depleted uranium (up to approximately 15 per year)
- Experiments with small quantities of actinides, high explosives, and sources (up to approximately 20 per year)

Accelerator-Driven Transmutation Technology. LANL would conduct basic research using existing LANSCE facilities.

Subatomic Physics Research. LANL would conduct 5 to 10 physics experiments annually at the Manuel Lujan Center and WNR and conduct proton radiography experiments. Proton radiography experiments would include contained experiments using small to moderate quantities of high explosives, similar to those discussed above under Neutron Research and Technology.

Medical Isotope Production. Up to approximately 20 targets per year would be irradiated for medical isotope production.

High-Power Microwaves and Advanced Accelerators. Research and development in this area would be conducted at reduced levels (about 50 percent) as compared to the No Action Alternative levels. Microwave chemistry research for industrial and environmental applications would not be conducted.

Under all alternatives, the following facilities (as described under the No Action Alternative, section 3.1.11, and in chapter 2, section 2.2.2.11) would be constructed and operated (based on previous NEPA reviews):

- LEDA
- Proton radiography and neutron spectroscopy facilities
- IPF relocation
- SPSS enhancement

3.3.12 Health Research Laboratory

The HRL is described in chapter 2 (section 2.2.2.12). Under the Reduced Operations Alternative, the following activities would occur at this facility.

Genomic Studies. LANL would reduce genomic studies at HRL to approximately 20 percent of the No Action Alternative level.

Cell Biology. LANL would decrease research activities to approximately 30 percent of the No Action Alternative level.

Cytometry. LANL's research utilizing laser imaging systems to analyze the structures and functions of subcellular systems would be reduced to approximately 25 percent of the No Action Alternative level.

DNA Damage and Repair. LANL's research using isolated cells to investigate DNA repair mechanisms would be reduced to approximately 30 percent of the No Action Alternative levels.

Environmental Effects. LANL would conduct research that identifies specific changes in DNA and proteins in certain microorganisms that occur after events in the environment to a level approximately 40 percent of than the No Action Alternative.

Structural Cell Biology. LANL would conduct research utilizing chemical and crystallographic techniques to isolate and characterize the three-dimensional shapes and properties of DNA and protein molecules to a level approximately 20 percent of that under the No Action Alternative.

Neurobiology. LANL's activities in neurobiology, conducting research using magnetic fields produced in active areas of the brain to map human brain locations associated with certain sensory and cognitive functions, would be the same as that of the No Action Alternative.

In-Vivo Monitoring. LANL would conduct 500 whole-body scans annually.

3.3.13 Radiochemistry Facility

The Radiochemistry Facility is described in section 2.2.2.13. As an indicator of overall activity levels, these operations would be expected to require about 130 FTEs. Under the Reduced Operations Alternative, the following activities would occur at this facility.

Radionuclide Transport. LANL would conduct 18 to 36 of these studies annually.

Environmental Remediation. Environmental remediation activities would be the same as the No Action Alternative level of operations.

Ultra-Low-Level Measurements. These activities would be slightly lower than the No Action Alternative level.

Nuclear/Radiochemistry. These operations would be approximately half of the No Action Alternative levels.

Isotope Production. LANL would conduct target preparation, irradiation, and processing to recover medical and industrial application isotopes at a level approximately half that of the No Action Alternative.

Actinide/Transuranic Chemistry. LANL also would perform radiochemical separations at half the No Action Alternative level of operations.

Data Analysis. LANL would reexamine archive data and measure nuclear process parameters of interest to weapons radiochemists at a level slightly lower than the No Action Alternative level.

Inorganic Chemistry. LANL would conduct synthesis, catalysis, and actinide chemistry activities the same level as the No Action Alternative.

Structural Analysis. LANL would perform these activities at the No Action Alternative level of operation.

Sample Counting. LANL's sample counting activity would also be the same as the No Action Alternative.

3.3.14 Radioactive Liquid Waste Treatment Facility

The RLWTF is described in chapter 2 (section 2.2.2.14). Under the Reduced Operations Alternative, the following activities would occur at this facility.

Waste Characterization, Packaging, and Labeling. Under the Reduced Operations Alternative, as under the No Action Alternative, LANL would support, certify, and audit generator characterization programs and maintain the WAC for the RLWTF.

Waste Transport, Receipt, and Acceptance. LANL would also collect radioactive liquid waste from generators and transport it to the RLWTF in TA–50.

Radioactive Liquid Waste Pretreatment. LANL would pretreat 158,400 gallons (600,000 liters) of RLW per year at TA–21; 5,280 gallons (20,000 liters) of RLW per year at TA–50; and solidify, characterize, and package 71 cubic feet (2 cubic meters) of TRU waste sludge per year at TA–50.

Radioactive Liquid Waste Treatment. LANL would install equipment for nitrate reduction in mid 1999, treat 5.28 million gallons (20 million liters) of RLW per year; dewater, characterize, and package 247 cubic feet (7 cubic meters) of LLW sludge per year; and solidify, characterize, and package 671 cubic feet (19 cubic meters) of TRU waste sludge per year.

Decontamination Operations. LANL would:

- Decontaminate personnel respirators for reuse (approximately 300 per month).
- Decontaminate air-proportional probes for reuse (approximately 200 per month).
- Decontaminate vehicles and portable instruments for reuse (as required).
- Decontaminate precious metals for resale (acid bath).
- Decontaminate scrap metals for resale (sand blast).
- Decontaminate 6,700 cubic feet (190 cubic meters) of lead for reuse (grit blast).

Three modifications were recently completed or are planned for the RLWTF: an upgrade to the influent tank system, installation of a new process for treatment of RLW, and installation of additional treatment steps for removal of nitrates. These have all been previously reviewed under NEPA and are included in all of the SWEIS alternatives, as described under the No Action Alternative, section 3.1.14 and in chapter 2 (section 2.2.2.14).

3.3.15 Solid Radioactive and Chemical Waste Facilities

The Solid Radioactive and Chemical Waste Facilities are described in section 2.2.2.15. Under the Reduced Operations Alternative, the following activities would occur at these facilities.

Waste Characterization, Packaging, and Labeling. Under the Reduced Operations Alternative, as under the No Action Alternative, LANL would support, certify, and audit generator characterization programs and maintain the WAC for LANL waste management facilities. At the Solid Radioactive and Chemical Waste Facilities, LANL would characterize 26,800 cubic feet (760 cubic meters) of legacy LLMW; characterize 318,000 cubic feet (9,010 cubic meters) of legacy TRU waste; verify characterization data at the RANT Facility for unopened containers of LLW and TRU waste; maintain the WAC for off-site treatment, storage, and disposal facilities; and overpack and bulk waste containers.

As under the No Action Alternative, LANL would also perform coring and visual inspection of a percentage of TRU waste packages, ventilate 16,700 drums of TRU waste retrieved during the TWISP, and maintain the current version of the WIPP WAC and coordinate with WIPP operations.

Compaction. LANL would compact up to 590,000 cubic feet (16,700 cubic meters) of LLW.

Size Reduction. In addition, 91,800 cubic feet (2,600 cubic meters) of TRU waste would be reduced in size at the WCRR Facility in TA–50 and the Drum Preparation Facility in TA–54 (the same level as under the No Action Alternative).

Waste Transport, Receipt, and Acceptance. LANL would collect chemical and mixed wastes from LANL generators and transport them to TA–54. LANL would ship 31,960 tons (29,000 metric tons) of chemical wastes and 126,000 cubic feet (3,570 cubic meters) of LLMW for off-site treatment and disposal in accordance with EPA land disposal restrictions. In addition, LANL would ship 2,578,000 cubic feet (73,030 cubic meters) of LLW for off-site disposal. (This corresponds to shipment of LANL LLW to an off-site [e.g., regional] disposal facility to the extent practicable.) Beginning in 1999, 318,000 cubic feet (9,010 cubic meters) of legacy TRU waste would be shipped to WIPP. LANL would also ship 67,100 cubic feet (1,900 cubic meters) of TRU waste generated as a result of future operations and research to WIPP and 100,600 cubic feet (2,850 cubic meters) of LLMW in environmental restoration soils for off-site solidification and disposal.

Waste Storage. As under the No Action Alternative, prior to shipment to off-site treatment, storage, and disposal facilities, LANL would store chemical and mixed wastes. LANL would also store: legacy TRU waste until WIPP is opened for disposal; LLMW until treatment facilities are available; and LLW uranium chips until sufficient quantities were accumulated for stabilization campaigns.

Waste Retrieval. LANL would retrieve 166,000 cubic feet (4,700 cubic meters) of TRU waste from Pads 1, 2, and 4 by 2004 (same level as the No Action Alternative).

Other Waste Processing. LANL would demonstrate treatment (e.g., electrochemical) of LLMW liquids, land farm oil-contaminated soils at Area J, stabilize 14,500 cubic feet (410 cubic meters) of uranium chips, and provide special case treatment for 23,650 cubic feet (670 cubic meters) of TRU waste. These activities would be the same as under the No Action Alternative.

Disposal. LANL would dispose of 3,530 cubic feet (100 cubic meters) of LLW in shafts at Area G, 98,800 cubic feet (2,800 cubic meters) of LLW and small quantities of radioactively contaminated PCBs in disposal cells at Area G (this is the LANL LLW for which LANL has a unique disposal capability, or for which there is no approved transportation configuration), approximately 3,530 cubic feet (100 cubic meters) of administratively controlled industrial solid wastes in cells at Area J annually, and nonradiological classified wastes in shafts at Area J.

In addition, under all alternatives, LANL would construct storage domes for TRU wastes recovered from Pads 1, 2, and 4. This is described under the No Action Alternative, section 3.1.15.

3.4 GREENER ALTERNATIVE

The name and general description for this alternative were provided by interested citizens as a result of the scoping process. The Greener Alternative uses existing LANL capabilities with an emphasis on basic science, waste minimization and treatment, dismantlement of nuclear weapons, nonproliferation, and other areas of national and international importance. Thus, while similar activities may occur under both the Expanded Operations and Greener Alternatives, the purpose for which the activities would be conducted under the Greener Alternative would focus on science, waste management, and nuclear weapons dismantlement.

This alternative does not change any LANL missions, nor add or eliminate LANL programs or projects. This alternative includes increased activities and operations in areas of emphasis including: neutron science, health and nuclear medicines research, basic science research (e.g., the fundamental nature of matter), waste minimization technologies, environmental restoration technologies, nuclear weapons dismantlement, international nuclear safety, and nonproliferation. These increased activities are combined with the Reduced Operations or No Action levels of defense mission activities at LANL to make up the Greener Alternative.

Construction projects required for LANL support operations are included in the Greener Alternative. Construction also may be necessary to support consolidation of various operations to a reduced "footprint," to optimize some facilities for increased levels of operations, and/or to increase LANL capabilities and capacities as required to accomplish assigned programs, projects, and activities. These construction or upgrade activities are identified insofar as they are associated with key facilities, as described below.

3.4.1 Plutonium Facility Complex

The Plutonium Facility Complex (TA–55) is described in chapter 2 (section 2.2.2.1). Under the Greener Alternative, the following activities would occur at this complex.

Plutonium Stabilization. LANL would recover, process, and store its existing plutonium residue inventory in 8 years.

Manufacturing Plutonium Components. As with the Reduced Operations Alternative, LANL would produce up to 12 plutonium pits per year in order to maintain the technical capability to understand pit characteristics and behavior. In addition, it would fabricate other parts and samples for research and development at the same levels as under the No Action Alternative.

Surveillance and Disassembly of Weapons Components. LANL would disassemble up to 65 pits per year (up to 40 pits would be destructively examined). Up to 20 pits would be nondestructively examined.

Actinide Materials Science and Processing Research and Development. As under the No Action Alternative, LANL would continue to conduct research on plutonium (and other actinide) materials. The types and levels of these activities are the same under this alternative as under the No Action Alternative. LANL would demonstrate the disassembly/conversion of 1 to 2 pits per day (up to 40 pits total) using hydride-dehydride processes. LANL would expand research in the material disposition technologies to support weapon disassembly. Up to 5,000 curies of neutron sources (plutonium-239/beryllium and americium-241/beryllium) and neutron sources other than sealed sources would be processed. LANL would not process actinides and would not use tritium separation, but would retain these capabilities. LANL would perform decontamination of 10 to 15 uranium components per month.

Research in support of DOE's actinide clean-up activities and on actinide processing and waste activities at DOE sites would be conducted at the same level as the Expanded Operations Alternative. In addition, as under the Expanded Operations Alternative, LANL would stabilize larger quantities of specialty items and residues from other DOE sites. As under the No Action Alternative, LANL would fabricate and study small amounts of nuclear fuels used in terrestrial and space reactors; fabricate and study prototype fuel for lead test assemblies; and analyze samples. As under the Expanded Operations Alternative, LANL would develop safeguards instrumentation for plutonium assay at a level increased from that of the No Action Alternative.

Fabrication of Ceramic-Based Reactor Fuels. LANL would make prototype MOX fuel and would continue research and development on other fuels.

Plutonium-238 Research, Development, and Applications. LANL would process, evaluate, and test up to 55 pounds (25 kilograms) of plutonium-238 per year in production of materials and parts to support space and terrestrial uses. In addition, LANL would recover, recycle, and blend up to 40 pounds (18 kilograms) per year of plutonium-238.

Storage, Shipping, and Receiving. The NMSF is to be renovated to perform as originally intended: to serve as a vault for the interim storage of up to 7.3 tons (6.6 metric tons) of the LANL SNM inventory, mainly plutonium. The NMSF renovation is included in all alternatives.

Under all alternatives, the Plutonium Facility would be renovated to ensure the continued availability of existing capabilities, as described under the No Action Alternative, section 3.1.1.

It is recognized that projects plans change over time. If this alternative is selected, the construction projects proposed under this alternative (as described above), would be reviewed prior to construction to determine whether additional NEPA analysis is required.

3.4.2 Tritium Facilities

The Tritium Facilities are described in chapter 2 (section 2.2.2.2). Under the Greener Alternative, the following activities would occur at these facilities.

High-Pressure Gas Fills and Processing. LANL would handle and process tritium gas in quantities of up to 3.53 ounces (100 grams) at the WETF approximately 20 times per year.

Gas Boost System Testing and Development. Approximately 15 times per year, LANL would conduct gas boost system research, development, and testing and gas processing operations at WETF involving quantities of up to to 3.53 ounces (100 grams) of tritium.

Cyrogenic Separation. At TSTA, LANL would purify and process tritium gas in quantities of up to 7.06 ounces (200 grams) in five to six operations per year using cryogenic separation for the purpose of alternative energy development.

Diffusion and Membrane Purification. LANL would conduct research on tritium movement and penetration through materials in including major experimental efforts approximately six to eight experiments per month and continuous use for effluent treatment, with a focus on waste reduction.

Metallurgical and Material Research. LANL also would conduct metallurgical and materials research involving tritium, including research and application studies regarding tritium storage.

Thin Film Loading. In addition, LANL would use its thin film loading capability (involving chemically bonding tritium to a metallic surface) for tritium loading of neutron tube targets, processing approximately 800 units per year using small quantities of tritium (same as the No Action Alternative).

Gas Analysis. LANL's activities to measure the composition and quantities of gases used would increase from the No Action Alternative level in support of tritium operations under this alternative.

Calorimetry. LANL's calorimetry measurements (a nondestructive method of measuring the amount of tritium in a container) would increase (as compared to the No Action Alternative) under this alternative in support of tritium operations.

Solid Material and Container Storage. Tritium would continue to be stored on site in WETF, TSTA, and TSFF.

Under all alternatives, LANL would remodel Building 16–450 and connect it to WETF in support of neutron tube target loading.

3.4.3 Chemistry and Metallurgy Research Building

The CMR Building is described in chapter 2 (section 2.2.2.3). Under the Greener Alternative, the following activities would occur at this facility.

Analytical Chemistry. LANL would provide sample analysis in support of actinide research and processing activities, processing approximately 5,200 samples per year (same as the No Action Alternative).

Uranium Processing. LANL would conduct activities to recover, process, and store LANL's highly enriched uranium inventory over the next 8 years (same as the No Action Alternative).

Destructive and Nondestructive Analysis. Up to a total of 10 secondary assemblies (1 per year) would be evaluated through destructive and nondestructive analysis and disassembly (same as the No Action Alternative).

Nonproliferation Training. LANL would also conduct more nonproliferation training using quantities of SNM than under the No Action Alternative and would possibly use different types of SNM in that training.

Actinide Research and Processing. LANL would process up to 5,000 curies of neutron sources (both plutonium-238/beryllium and americium-241/beryllium sources) per year and would process neutron sources other than sealed sources. In addition, up to a total of 1,000 plutonium-238/beryllium and americium-241/beryllium neutron sources would be staged in CMR Building Wing 9 floor holes. LANL would begin a research and development effort on spent nuclear fuels related to long-term storage and would analyze components in spent and partially spent fuels, including research and development into monitoring of spent reactor fuels. Further, LANL would characterize approximately 50 samples per year using metallurgical microstructural/chemical analysis and would conduct compatibility testing of actinides and other metals in order to study long-term aging and other material effects. LANL would also conduct analysis of TRU waste disposal related to the validation of WIPP performance assessment models, characterize TRU waste, and analyze gas generation such as that which could occur during transportation to WIPP. Further, LANL would demonstrate decontamination technologies for actinide-contaminated soils and materials and develop an actinide precipitation method to reduce mixed wastes in LANL effluents.

Fabrication and Metallography. LANL would produce 1,080 targets per year for production of molybdenum-99, with each target containing approximately 0.71 ounces (20 grams) of uranium-235. In addition, LANL would support highly enriched uranium processing research and development pilot operations and casting and fabricate metal shapes using from 2.2 to 22 pounds (1 to 10 kilograms) of highly enriched uranium in each operation, with an annual throughput of approximately 2,200 pounds (1,000 kilograms) (which would be retained in the LANL material inventory). (These activities are at the same levels as under the No Action Alternative.)

In addition, four projects currently in development or implementation at the CMR Building are included in all alternatives, as described under the No Action Alternative, section 3.1.3.

3.4.4 Pajarito Site (Los Alamos Critical Experiments Facility)

The Pajarito Site is described in chapter 2 (section 2.2.2.4). Under the Greener

Alternative, the following activities would occur at this facility.

LANL would continue to conduct experiments and tests in all of the areas described in section 2.2.2.4. The level of dosimeter assessment and calibration, skyshine, and vaporization experiments would be the same as the No Action Alternative; other experiments would increase by about 25 percent over the No Action Alternative level (the same as the Expanded Operations Alternative). In those areas where nuclear criticality experiments would increase, the nuclear materials inventory would increase by about 20 percent over the No Action Alternative level. As under the No Action Alternative, LANL would also develop safeguards instrumentation and perform research and development activities for SNM, light detection and ranging experiments, materials processing, interrogation techniques, and field systems.

3.4.5 Sigma Complex

The Sigma Complex is described in section 2.2.2.5. Under the Greener Alternative, the following activities would occur at this complex.

Research and Development on Materials Fabrication, Coating, Joining, and Processing. Under the Greener Alternative, as under the No Action Alternative, LANL would continue to fabricate items from metals, ceramics, salts, beryllium, enriched uranium, depleted uranium, and other uranium isotope mixtures. Activities include casting, forming, machining, polishing, coating, and joining.

Characterization of Materials. LANL would also continue research and development activities on properties of ceramics, oxides, slicides, composites, and high-temperature materials; analyze up to 24 tritium reservoirs per year; and develop a library of aged non-SNM materials from stockpiled weapons and develop techniques to test and predict changes. As under the Expanded Operations Alternative, up to 2,500 non-SNM samples, including uranium, would be stored and characterized.

Fabrication of Metallic and Ceramic Items. LANL would (as under the No Action Alternative), on an annual basis, fabricate stainless steel and beryllium components for approximately 50 plutonium pits, 50 to 100 reservoirs for tritium, components for up to 50 secondary assemblies (of depleted uranium, depleted uranium alloy, enriched uranium, deuterium, and lithium), nonnuclear components for research and development (30 major hydrotests and 20 to 40 joint test assemblies, beryllium targets, targets and other components for accelerator production of tritium research, test storage containers for nuclear materials stabilization, and nonnuclear (stainless steel and beryllium) components for up to 20 plutonium pit rebuilds.

In addition, all of the alternatives include construction, renovation, and modification projects that are underway and planned in the near term for the purpose of maintaining the availability and viability of the Sigma Complex, as described under the No Action Alternative, section 3.1.5.

It is recognized that project plans change over time. If this alternative is selected, the construction projects proposed under this alternative (as described above), would be reviewed prior to construction to determine whether additional NEPA analysis is required.

3.4.6 Materials Science Laboratory

The MSL is described in chapter 2 (section 2.2.2.6). Under the Greener Alternative, the following activities would occur at this facility.

Materials Processing. LANL would continue research at current levels for six of its eight materials processing activities at the MSL; these capabilities are: thermomechanical processing, microwave processing, heavy equipment materials, single crystal growth, amorphous alloys, and powder processing. The materials synthesis/processing activities would be expanded for nonweapons applications and to develop environmental and waste management technologies; wet chemistry would be expanded to develop a remediation chemistry capability.

Mechanical Behavior in Extreme Environments. LANL would continue dynamic testing and fabrication and assembly research at current levels. Mechanical testing would be expanded for nonweapons applications.

Advanced Materials Development. LANL would continue activities in materials, synthesis and characterization, and ceramics capabilities at current levels of research; the research effort for high-temperature superconductors would be increased from the No Action Alternative level.

Materials Characterization. LANL would also expand activities in the six materials characterization areas: surface science chemistry, corrosion characterization, electron microscopy, x-ray, optical metallography, and spectroscopy. Research into environmental corrosives would also be conducted.

3.4.7 Target Fabrication Facility

The Target Fabrication Facility is described in section 2.2.2.7. Under the Greener Alternative, the following activities would occur at this facility. (These are the same as the No Action Alternative levels.)

Precision Machining and Target Fabrication. LANL would provide targets and specialized components for approximately 1,200 laser and physics tests per year, including a 10 percent annual growth in operations for the next 10 years.

Polymer Synthesis. LANL would produce polymers for targets and specialized components for approximately 1,200 laser and physics tests per year, including a 10 percent annual growth in operations for the next 10 years. Other activities at this facility would be redirected to advanced materials research and manufacturing, waste treatment, energy technologies, and environmental restoration technology, with the potential for a moderate increase in operations.

Chemical and Physical Vapor Deposition. LANL would coat targets and specialized components for approximately 1,200 laser and physics tests per year, including a 10 percent annual growth in operations for the next 10 years. Other activities at this facility would be redirected to advanced materials research and manufacturing, waste treatment, energy technologies, and environmental restoration technology, with the potential for a moderate increase in operations. Support for pit manufacturing operations would be the same as under the No Action Alternative.

3.4.8 Machine Shops

The Machine Shops are described in chapter 2 (section 2.2.2.8). Under the Greener Alternative, the following activities would occur at this facility. (These are at the same levels as under the No Action Alternative.)

The Machine Shops would provide fabrication support for the dynamic experiments program and explosive research studies, support up to 30 hydrodynamic tests annually, manufacture 20 to 40 joint test assembly sets annually, and provide general laboratory fabrication support as requested. LANL would also continue its fabrication activities using unique and unusual materials and provide appropriate dimensional inspection of these activities.

3.4.9 High Explosives Processing Facilities

The High Explosives Processing Facilities are described in section 2.2.2.9. Under this alternative, 19,400 pounds (8,800 kilograms) of explosives and 1,150 pounds (520 kilograms) of mock explosives would be used annually (as an indicator of overall activity levels in this key facility). Under the Greener Alternative, the following activities would occur at these facilities.

High Explosives Synthesis and Production. Under the Greener Alternative, as under the Reduced Operations Alternative, LANL would reduce its current level of high explosives synthesis and production research and development, production of new materials and formulation of plastic-bonded explosives by approximately 60 percent. Process development would decrease over current levels and materials and components for directed stockpile production would be produced at a reduced level (approximately 60 percent of the No Action Alternative).

High Explosives and Plastics Development and Characterization. LANL would evaluate stockpile returns and decrease efforts in development and characterization of new plastics and high explosives for stockpile improvement. LANL would also conduct research into high explosives waste treatment methods, with the overall level of effort reduced to about 60 percent of the No Action Alternative.

High Explosives and Plastics Fabrication. LANL would reduce its traditional stockpile surveillance and process development over No Action Alternative levels by approximately 60 percent. Stockpile surveillance fabrication for hydrodynamic and environmental testing would be reduced to approximately 75 percent of the No Action Alternative.

Test Device Assembly. Operations would be increased over current levels to support stockpile related hydrodynamic tests, joint test assemblies, environmental and safety tests, and slightly increased research and development activities. Approximately 30 major hydrodynamic test devices would be assembled annually.

Safety and Mechanical Testing. As under the Reduced Operations Alternative, safety and environmental testing related to stockpile assurance would be reduced to approximately 80 percent of No Action Alternative levels and predictive models would be improved. Approximately 12 safety and mechanical tests would be conducted annually.

Research, Development, and Fabrication of High-Power Detonators. As under the No Action Alternative, LANL would increase efforts to support SSM activities, manufacture up to 20 major product lines per year, and support DOE-wide packaging and transportation of electro-explosive devices.

3.4.10 High Explosives Testing

High explosives testing is described in chapter 2 (section 2.2.2.10). The Greener Alternative for LANL's high explosives testing facilities is the same as the No Action Alternative, section 3.1.10.

3.4.11 Los Alamos Neutron Science Center

LANSCE is described in section 2.2.2.11. Under the Greener Alternative, the following activities would occur at this facility.

Accelerator Beam Delivery, Maintenance, and Development. LANSCE would deliver a linear accelerator beam to Areas A, B, and C; the WNR buildings; the Manuel Lujan Center; the dynamic test facility; and a new IPF for 10 months each year (6,400 hours). The H^+

beam current would be 1,250 microamps and the H^- beam current would be 200 microamps. The beam delivery and support equipment would be reconfigured to support new facilities, upgrades, and experiments.

A 40-million electron volt LEDA would be built and operated in an existing facility (TA–53–365) for 10 to 15 years, operating up to approximately 6,600 hours per year. This facility would be constructed and operated as described under the Expanded Operations Alternative, section 3.1.11.

Experimental Area Support. Support activities would continue, consistent with the levels of operation under this alternative. Remote handling and packaging of radioactive materials and wastes at LANSCE would increase to handle waste generation that results from the facility construction and modifications at LANSCE for LPSS and for the decontamination of Area A East under this alternative.

Neutron Research and Technology. LANL would conduct 1,000 to 2,000 different experiments annually, using neutrons from the Manuel Lujan Center, WNR, and the LPSS. LANL would construct and operate the LPSS as described under the Expanded Operations Alternative, section 3.2.11.

LANL also would continue to support contained weapons-related experiments using small to moderate quantities of high explosives. These experiments would include:

- Experiments with nonhazardous materials and small quantities of high explosives (up to approximately 100 per year)
- Experiments with up to 10 pounds (4.54 kilograms) of high explosives and/or depleted uranium (up to approximately 30 per year)
- Experiments with small quantities of actinides, high explosives, and sources (up to approximately 40 per year)
- Shockwave experiments involving small amounts, up to nominally 0.18 ounce (5 grams), of plutonium

Accelerator-Driven Transmutation Technology. LANL would conduct lead target tests for 2 years at the Area A beam stop; construct and operate the 1-megawatt, and then the 5-megawatt target/blanket experiments, as described under the Expanded Operations Alternative, section 3.2.11.

Subatomic Physics Research. LANL would conduct 5 to 10 physics experiments annually at Manuel Lujan Center, WNR, and LPSS and conduct proton radiography experiments. Proton radiography experiments would include contained experiments using small to moderate quantities of high explosives, similar to those described above under Neutron Research and Technology.

Medical Isotope Production. Up to approximately 50 targets per year would be irradiated for medical isotope production and exotic and neutron rich/deficient isotopes would be produced. LANL would also construct and operate the Exotic Isotope Production Facility as described under the Expanded Operations Alternative, section 3.2.11.

LANL would decontaminate Area A East as described under the Expanded Operations Alternative, section 3.2.11.

High-Power Microwave and Advanced Accelerators. Research and development in this area would be conducted at the same levels described under the No Action Alternative.

Under all alternatives, the following facilities (as described under the No Action Alternative, section 3.1.11 and in chapter 2, section 2.2.2.11) would be constructed and operated (based on previous NEPA reviews):

- LEDA

- Proton radiography and neutron spectroscopy facilities
- IPF relocation
- SPSS enhancement

It is recognized that project plans change over time. If this alternative is selected, the construction projects proposed under this alternative (as described above), would be reviewed prior to construction to determine whether additional NEPA analysis is required.

3.4.12 Health Research Laboratory

The HRL is described in chapter 2 (section 2.2.2.12). With one exception, activities at HRL under the Greener Alternative would be the same as those described for the Expanded Operations Alternative in section 3.2.12. LANL's neurobiology research, using magnetic fields produced in active areas of the brain to map human brain locations associated with certain sensory and cognitive functions, would be increased to twice the level of the No Action Alternative.

3.4.13 Radiochemistry Facility

The Radiochemistry Facility is described in section 2.2.2.13. As an indicator of overall activity levels, these operations would be expected to require about 250 FTEs. Under the Greener Alternative, the following activities would occur at this facility.

Radionuclide Transport. Under the Greener Alternative, as under the Expanded Operations Alternative, LANL would conduct 80 to 160 of these studies annually, but the studies would support environmental remediation.

Environmental Remediation. Environmental remediation activities would be the same as the Expanded Operations Alternative (approximately double the No Action Alternative level of operations).

Ultra-Low-Level Measurements. These activities would also be at the same levels as the Expanded Operations Alternative (about double the No Action Alternative level).

Nuclear/Radiochemistry. These operations would be approximately the same as the No Action Alternative overall levels; however, weapons work would be reduced by half, and nonweapons work would be increased by 10 percent.

Isotope Production. LANL would conduct target preparation, irradiation, and processing to recover medical and industrial application isotopes at the same level as the No Action Alternative.

Actinide/Transuranic Chemistry. LANL also would perform radiochemical separations at the No Action Alternative level of operations; however, these activities would support nonweapons programs.

Data Analysis. LANL would re-examine archive data and measure nuclear process parameters of interest to weapons radiochemists at a level slightly lower than the No Action Alternative level (same as under the Reduced Operations Alternative).

Inorganic Chemistry. LANL would conduct synthesis, catalysis, and actinide chemistry activities at a level approximately 50 percent higher than that of the No Action Alternative.

Structural Analysis. As under the Expanded Operations Alternative, LANL would perform these activities at approximately twice the No Action Alternative level of operation.

Sample Counting. LANL's sample counting activity to measure the quantity of radioactivity in samples using alpha, beta, and gamma ray counting systems would be the same as the No Action Alternative.

3.4.14 Radioactive Liquid Waste Treatment Facility

The RLWTF is described in chapter 2 (section 2.2.2.14). Under the Greener Alternative, the following activities would occur at this facility.

Waste Characterization, Packaging, and Labeling. Under the Greener Alternative, as under the No Action Alternative, LANL would support, certify, and audit generator characterization programs and maintain the WAC for the RLWTF.

Waste Transport, Receipt, and Acceptance. LANL would also collect radioactive liquid waste from generators and transport it to the RLWTF in TA–50.

Radioactive Liquid Waste Pretreatment. LANL would pretreat 185,000 gallons (700,000 liters) of RLW per year at TA–21; 6,600 gallons (25,000 liters) of RLW per year at TA–50; and solidify, characterize, and package 71 cubic feet (2 cubic meters) of TRU waste sludge per year at TA–50.

Radioactive Liquid Waste Treatment. LANL would install equipment for nitrate reduction in mid 1999, treat 6.6 million gallons (25 million liters) of RLW per year; dewater, characterize, and package 247 cubic feet (7 cubic meters) of LLW sludge per year; and solidify, characterize, and package 812 cubic feet (23 cubic meters) of TRU waste sludge per year. This would be the same level of operations as the No Action Alternative.

Decontamination Operations. The decontamination operations at RLWTF under the Greener Alternative would be the same as those under the No Action Alternative described in section 3.1.14.

Three modifications were recently completed or are planned for the RLWTF: an upgrade to the influent tank system, installation of a new process for treatment of RLW, and installation of additional treatment steps for removal of nitrates. These have all been previously reviewed under NEPA and are included in all of the SWEIS alternatives, as described under the No Action Alternative, section 3.1.14 and in section 2.2.2.14.

3.4.15 Solid Radioactive and Chemical Waste Facilities

The Solid Radioactive and Chemical Waste Facilities are described in section 2.2.2.15. Under the Greener Alternative, the following activities would occur at these facilities.

Waste Characterization, Packaging, and Labeling. Under the Greener Alternative, as under the No Action Alternative, LANL would support, certify, and audit generator characterization programs and maintain the WAC for LANL waste management facilities. At the Solid Radioactive and Chemical Waste Facilities, LANL would characterize 26,800 cubic feet (760 cubic meters) of legacy LLMW; characterize 318,000 cubic feet (9,010 cubic meters) of legacy TRU waste; verify characterization data at the RANT Facility for unopened containers of LLW and TRU waste; maintain the WAC for off-site treatment, storage, and disposal facilities; and overpack and bulk waste containers.

As under the No Action Alternative, LANL would also perform coring and visual inspection of a percentage of TRU waste packages, ventilate 16,700 drums of TRU waste retrieved during the TWISP, and maintain the current version of the WIPP WAC and coordinate with WIPP operations.

Compaction. LANL would compact up to 706,000 cubic feet (20,000 cubic meters) of LLW.

Size Reduction. In addition, 91,800 cubic feet (2,600 cubic meters) of TRU waste would be reduced in size at the WCRR Facility in TA–50 and the Drum Preparation Facility in TA–54 (the same level as under the No Action Alternative).

Waste Transport, Receipt, and Acceptance. LANL would collect chemical and mixed wastes from LANL generators and transport them to TA–54. LANL would ship 32,000 tons (29,000 metric tons) of chemical wastes and 127,400 cubic feet (3,610 cubic meters) of LLMW for off-site treatment and disposal is accordance with EPA land disposal restrictions. In addition, LANL would ship 2,587,500 cubic feet (73,300 cubic meters) of LLW for off-site disposal. (This corresponds to shipment of LANL LLW to an off-site [e.g., regional] disposal facility to the extent practicable.) Beginning in 1999, 318,000 cubic feet (9,010 cubic meters) of legacy TRU waste would be shipped to WIPP. LANL would also ship 87,900 cubic feet (2,490 cubic meters) of TRU waste generated as a result of future operations and research to WIPP and 100,600 cubic feet (2,850 cubic meters) of LLMW in environmental restoration soils for off-site solidification and disposal.

Waste Storage. As under the No Action Alternative, prior to shipment to off-site treatment, storage, and disposal facilities, LANL would store chemical and mixed wastes. LANL would also store: legacy TRU waste until WIPP is opened for disposal; LLMW until treatment facilities are available; and LLW uranium chips until sufficient quantities were accumulated for stabilization campaigns.

Waste Retrieval. LANL would retrieve 165,900 cubic feet (4,700 cubic meters) of TRU waste from Pads 1, 2, and 4 by 2004 (same level as the No Action Alternative).

Other Waste Processing. LANL would demonstrate treatment (e.g., electrochemical) of LLMW liquids, land farm oil-contaminated soils at Area J, stabilize 14,500 cubic feet (410 cubic meters) of uranium chips, and provide special case treatment for 23,650 cubic feet (670 cubic meters) of TRU waste. These activities would be the same as under the No Action Alternative.

Disposal. LANL would dispose of 14,500 cubic feet (410 cubic meters) of LLW in shafts at Area G, 423,600 cubic feet (12,000 cubic meters) of LLW and small quantities of radioactively contaminated PCBs in disposal cells at Area G (this is the LANL LLW for which LANL has a unique disposal capability, or for which there is no approved transportation configuration), approximately 3,530 cubic feet (100 cubic meters) of administratively controlled industrial solid wastes in cells at Area J annually, and nonradiological classified wastes in shafts at Area J.

In addition, under all alternatives, LANL would construct storage domes for TRU wastes recovered from Pads 1, 2, and 4. This is described under the No Action Alternative, section 3.1.15.

3.5 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL IN THE SWEIS

Comments received during prescoping and scoping were carefully considered by DOE. Several alternatives identified during scoping were examined by DOE but determined to be unreasonable because they could not be implemented within the 10-year time frame of the SWEIS analysis, or because they would not allow DOE to meet its core mission requirements. (LANL's support for DOE missions is described in chapter 1 [section 1.1].) These alternatives include: decommissioning of LANL, conversion to nondefense activities, privatization, and operating LANL exclusively as a National Environmental Research Park.

3.5.1 Decontamination and Decommissioning LANL

Under this alternative, LANL operations would be phased out and all facilities of LANL decontaminated and decommissioned as soon as practicable. The site is a government reservation, and therefore, would be transferred by the DOE property disposition process following decommissioning.

This alternative is not considered in detail in the SWEIS because it is unreasonable in the foreseeable future under the terms of the *National Defense Authorization Act of 1994* [Public Law (PL) 103–160] and presidential policy guidance on the future of the laboratories (DOE 1995a). Under this act, as well as national security policy, the maintenance of a safe and reliable nuclear weapons stockpile will remain a cornerstone of the U.S. nuclear deterrent for the foreseeable future and the continued vitality of all three DOE weapons laboratories (LANL, Lawrence Livermore National Laboratory, and Sandia National Laboratories) is essential to ensuring national security. Core intellectual and technical competencies and the facility capabilities and capacities housed in these weapons laboratories are essential to meeting DOE's technical responsibilities for development and maintenance of the U.S. nuclear weapon stockpile.

There is a clear national security requirement for continued operation of LANL for stockpile stewardship and management based on PL 103–160 and other statutes, the DoD Nuclear Posture Review, Presidential Decision Directives, and the Nuclear Weapon Stockpile Memorandum. It is also not economically feasible for certain specific work activities conducted at LANL to be reassigned to other DOE laboratories (see PL 103-160 and DOE 1996a, Volume I, Sections 2.2 and 2.3).

Therefore, because the continued operation of LANL is essential to DOE implementation of PL 103–160 and other statutes, as well as the Presidential Decision Directives and for U.S. compliance with treaties (including the first Strategic Arms Reduction Treaty [START I], START II, Nuclear Nonproliferation Treaty, and the Proposed comprehensive Test Ban Treaty), as well as extensive congressional guidance and national security policy implementation documents, decontamination and decommissioning of LANL is not a feasible alternative and is not considered in detail in the SWEIS.

3.5.2 Elimination of All Weapons-Related Work (Including Stockpile Stewardship and Management) from Continued Operation of LANL

Under this alternative, operations at LANL would continue, but all weapons work except currently authorized pit disassembly, stabilization, and storage would cease. This alternative is unreasonable because it would not allow DOE to meet its mission requirements under the terms of the *Atomic Energy Act of 1954* (42 U.S.C. §2011). This alternative is also unreasonable because of the unique expertise, capabilities, and responsibilities of DOE assigned under the *National Defense Authorization Act of 1994* (PL 103–160) as well as other acts and the 1995 presidential decision that declares that all three weapons laboratories are essential to meeting national security requirements (DOE 1995a). In fact, because of the proposed Comprehensive Test Ban Treaty and the moratorium on nuclear testing, the importance of operations at LANL supporting weapons safety and reliability has increased. LANL is the laboratory responsible for the design of the majority of nuclear weapons that are expected to continue to comprise the U.S. stockpile under the arms control agreements and treaties. With no new design weapons being produced, the U.S. will experience an increasingly aging nuclear stockpile. The average age of a stockpile weapon is currently 13 years. By the year 2005, the average age will be 20 years, which is the design basis for these weapons. The oldest weapons will be about 35 years old at that time. LANL is responsible for the safety and reliability of a substantial number of the weapons in the enduring stockpile.

The confidence in the performance of the nuclear explosives package has traditionally been based on underground nuclear detonation test data, aboveground experiments, computer simulations, surveillance data, and technical judgment. In a future without additional underground testing, the capabilities of LANL must be increasingly employed to assess and solve stockpile problems. The ability to assess nuclear components is more difficult without underground testing and with limited "aging" data; therefore, new facilities such as the DARHT Facility are critical to stockpile assurance (DOE 1995c). Repairs and replacements that are "certified" (that is, the weapon is assured to continue to be safe and reliable) will be needed to support even the most minimal stockpile projections (DOE 1996a, Volume I, Section 2.3.4). DOE must rely on improved experimental capabilities coupled with improved computational capability to address safety and reliance questions concerning the stockpile. These techniques are also essential to the nonproliferation, recovery, and disassembly of weapons and weapons components from outside the U.S.

For the foreseeable future, it is not reasonable to pursue a course that would eliminate weapons research and development, surveillance, computational analyses, components manufacturing, and experimentation from being undertaken at LANL because it would be counter to national security policy and congressional guidance. Further, moving these capabilities elsewhere would require expenditures that are unreasonable and significantly increase the risk of continued stockpile safety and reliability during the lengthy period required for relocation. (In any case, such a relocation could not reasonably be completed in the next 10 years.) Therefore, this alternative has been eliminated from further consideration in the SWEIS.

3.5.3 Operating LANL Exclusively as a National Environmental Research Park

In August 1977, LANL was dedicated as a National Environmental Research Park (NERP), a program managed by DOE in response to congressional legislation to set aside land for ecosystem preservation and study. In addition to LANL, six other NERPs are located at DOE sites and associated with national laboratories. The ultimate goal of programs associated with LANL is to encourage environmental research that will contribute to understanding how people can best live in balance with nature while enjoying the benefits of technology. Recent research at the NERP emphasizes understanding the fundamental processes governing the interaction of ecosystems and the hydrologic cycle on the Pajarito Plateau. The NERP remains a LANL program in accordance with legislation, but it was not intended to eliminate or to add missions or operations at a site.

An alternative to operate LANL exclusively as a NERP is not analyzed in the SWEIS because it is unfeasible in the foreseeable future and is not consistent with national security policy and LANL mission element assignments (chapter 1, section 1.1). DOE solicited potential new NERP projects during the scoping for the SWEIS. No specific projects were proposed by commentors as additional NERP projects for analysis in the SWEIS. Some activities that are closely related to the use of the LANL site as a NERP address DOE responsibilities as the Natural Resources Trustee. The Natural Resources Management Plan, initiated in part as a result of the SWEIS process, is being prepared to determine existing conditions management measures at LANL within the context of the Pajarito Plateau ecosystem (chapter 4, section 4.5.1.6).

3.5.4 Privatizing the Operations of LANL

Regardless of who operates LANL, the risks and potential consequences are functions of the specific activities assigned to LANL and the facilities, equipment, and procedures used to implement them. These facilities, equipment, and procedures would not be expected to change due to actions such as privatization. Therefore, this alternative is indistinct from the alternatives presented in sections 3.1 through 3.4.

There are restrictions on DOE privatization possibilities imposed under the terms of the *Atomic Energy Act of 1954* (42 U.S.C. §2015). Section 2015 governs the transfer of property and limits what DOE can do with real properties. Four subchapters govern what can be done with respect to government responsibilities over materials; Subchapter IV: Production of Special Nuclear Material; Chapter V: Special Nuclear Material; Subchapter VI: Source Material; and Subchapter VII: By-Product Materials. Furthermore, access to restricted data remains a responsibility of DOE (Subchapter XI).

For these reasons, this alternative was considered unreasonable and not considered in detail in the SWEIS. However, the risks posed by this alternative are not distinctly different from those of the No Action Alternative; the reader is referred to the description and consequences of that alternative.

3.6 COMPARISON OF POTENTIAL CONSEQUENCES AMONG ALTERNATIVES FOR CONTINUED OPERATION OF LANL

This section consists of four parts. The first part presents a summary of the differences across the SWEIS alternatives. The second part presents a summary comparison of the potential consequences of the four alternatives for continued operations of LANL. The detailed presentation of potential consequences of the four SWEIS alternatives is included in chapter 5. The third part presents a comparison of the potential consequences (of both construction and operations) of the alternatives for two specific projects, the Expansion of the TA–54/Area G Low-Level Waste Disposal Area and the Enhancement of Plutonium Pit Manufacturing. Details on the alternatives for siting and construction for these projects may be found in volume II of this SWEIS. The construction and operations for these projects are included in the SWEIS Expanded Operations Alternative, while the SWEIS No Action Alternative includes the alternative of not undertaking the construction (and maintaining operations at the level currently planned) for each of these projects. The fourth part summarizes the ER Project impacts and benefits; environmental restoration activities do not change across the SWEIS alternatives.

3.6.1 Summary of Differences in Activities Among the SWEIS Alternatives

The SWEIS alternatives for the continued operations of LANL are described in more detail in sections 3.1 through 3.4. The differences in activities at LANL among the alternatives are within the 15 SWEIS key facilities (each of which is described in chapter 2, section 2.2.2). Tables 3.6.1–1 through 3.6.1–30 (provided at the end of this chapter) summarize these differences. These tables are of two types and are intended to be complementary: (1) the Alternatives for Continued Operations tables reflect the activities (significant "markers" are reflected in the table; more complete descriptions are provided in sections 2.2, 3.1, 3.2, 3.3, and 3.4) within each of the key facilities and how these activities change across the SWEIS alternatives (the activity names on these tables match the capabilities discussed for each key facility in sections 2.2, 3.1, 3.2, 3.3, and 3.4); and (2) the Parameter Differences Among Alternatives for Continued Operations tables reflect facility-level emissions, waste generation, and other measures that are intended to clarify what the activity-by-activity descriptions mean (in total) for each SWEIS key facility. Table 3.6.1–31 is a parameter table for the LANL activities other than those at the key facilities. (These activities do not vary by alternative.)

3.6.2 Consequences of SWEIS Alternatives

Site-wide environmental consequences are summarized in two tables. Table 3.6.2–1 (provided at the end of this chapter) summarizes the potential consequences of normal operations of LANL under the four alternatives. Table 3.6.2–2 addresses the potential consequences of a range of transportation and operational accidents possible at LANL, including beyond design basis accidents. Accidents evaluated include: natural phenomena, process accidents, and accidents resulting from external human activities (such as airplane crashes and transportation accidents).

The major contributors to environmental impacts of operating LANL are wastewater discharges and radioactive air emissions.

- Historic discharges to Mortandad Canyon from the RLWFT have resulted in above background residual radionuclide (americium, plutonium, strontium-90, and

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DOE 1995c — *Dual Axis Radiographic Hydrodynamic Test Facility Final Environmental Impact Statement.* U.S. Department of Energy, Albuquerque Operations Office and Los Alamos Area Office. DOE/EIS-0228. Albuquerque, New Mexico. August 1995.

DOE 1995d — *Radioactive Source Recovery Program Environmental Assessment.* U.S. Department of Energy, Los Alamos Area Office. DOE/EA-1059. Los Alamos, New Mexico. December 1995.

DOE 1996a — *Final Programmatic Environmental Impact Statement for Stockpile Stewardship and Management.* U.S. Department of Energy. DOE/EIS-0236. Washington, D.C. September 1996.

DOE 1996b — *Low-Energy Demonstration Accelerator Environmental Assessment.* U.S. Department of Energy, Los Alamos Area Office. DOE/EA-1147. Los Alamos, New Mexico. April 1996.

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LANL 1996 *Final Report for the Expedited Cleanup of Material Disposal Area (MDA) M, TA–9.* Appendix F, "Asbestos and RCRA Metal Air Results." Prepared by NES, Inc. for Los Alamos National Laboratory. Los Alamos, New Mexico. April 1996.

LANL 1998 *Performance Assessment and Composite Analysis for the Los Alamos National Laboratory Low-Level Waste Material Disposal Area G*. Los Alamos National Laboratory. LA-UR-97-85. Los Alamos, New Mexico. Submitted to the U.S. Department of Energy March 1997. Approved October 1998.

cesium-137) concentrations as well as nitrates in alluvial groundwater and sediments.

- Plutonium deposits have been detected along the Rio Grande between Otowi and Cochiti Lake.
- The principal contributors to radioactive air emissions have been and continue to be the Los Alamos Neutron Science Center and high explosives testing activities.

In addition, trace amounts of tritium have been detected in some samples from the main aquifer. (Isolated results have indicated the presence of other radionuclides. However, results have not been duplicated in previous or subsequent samples, making these results suspect.)

The analysis in the SWEIS indicates that there would be very little difference in the environmental impacts among the SWEIS alternatives analyzed. The major discriminators among alternatives would be collective worker risk due to radiation exposure, socioeconomic effects due to LANL employment changes, and electrical power demand. The lack of notable differences arises from a number of factors. First, because there were very few specific new proposals of significant size, the alternatives describe a range of minimum to maximum operations within the constraints of existing facilities. Second, the lower limit for minimum operations in the major nuclear facilities is set by previous decisions (including those based on the SSM PEIS) regarding the assignment of mission and program elements. Third, when effects are not large to start with, the changes in resource parameters that arise from projected operations under the alternatives also do not result in large effects.

Often, there are no differences between accident impacts among the alternatives, largely as a result of conservative approaches used in accident frequency and public consequence. The inventories used in the analyses are typically those of permitted or administrative limits (i.e., controls on the maximum amounts of material that can be processed at one time and/or in storage), rather than operational values (i.e., the actual amount of material needed to perform the task). The operational values would be more likely to change among the alternatives. The administrative limits or inventories are selected so that the analyses are sufficiently conservative and bounding to cover maximum possible operational values. The accident frequencies depend upon the accident initiators, such as an aircraft crash, earthquake, or wildfire. These particular initiators are independent of the operations and of inventory; therefore, the frequency or likelihood of such an event remains constant among the alternatives. In the few cases of accidents in which the frequency depends upon operations, the variation in frequency among the alternatives does not necessarily translate into a significant change in the risk of an environmental release to the public because the value of a release is very small. Likewise, the risk to workers is affected by the change in frequency of the operations; but, the consequence of a single accident remains the same. The following information highlights the similarities and differences between the consequences of alternatives.

3.6.2.1 *Land Resources*

There is little difference in the impacts to land resources between the No Action, Reduced Operations, and the Greener Alternatives. Differences among the alternatives are primarily associated with operations in existing facilities and very little new development is planned. Therefore, these impacts are essentially the same as currently experienced. The Expanded Operations Alternative has very similar land resources impacts to those of the other three alternatives, with the principal differences being attributable to the visual impacts of lighting along the proposed transportation corridor (a mitigation measure intended to reduce the number of road closures and the accident risk associated with transportation under this alternative) and the noise and vibration associated with increased frequency of high explosives testing (as compared to the other three alternatives).

3.6.2.2 *Geology, Geological Conditions, and Soils*

There is little difference in the impacts to these resources across the alternatives. Wastewater discharge volumes with associated contaminants do change across the alternatives, but not to a degree noticeable in terms of impacts (such as causing soil erosion, for example). Under all of the alternatives, small quantities (as compared to existing conditions) of contaminants would be deposited in soils due to continued LANL operations and the ER Project would continue to remove existing contaminants at sites to be remediated.

Geological mapping and fault trenching studies at LANL are currently underway or recently completed to better define the rates of fault movement, specifically for the Pajarito Fault, and the location and possible southern termination of the Rendija Canyon Fault. Appendix I (in volume III) of the SWEIS presents a detailed status of the ongoing and recently completed seismic hazard studies, as well as the implications of these studies for LANL and DOE. That report indicates that slip rates (recurrence intervals for earthquakes) are within the parameters assumed in the 1995 seismic hazards study at LANL (chapter 4, section 4.2.2.2).

3.6.2.3 *Water Resources*

Water demand under all alternatives (section 3.6.2.9, below) is within existing DOE rights to water, and would result in average drops of 10 to 15 feet (3.1 to 4.6 meters) in the water levels in DOE well fields over the next 10 years. Except for cooling water used for the TA–53 accelerator facilities, there are not predominant industrial water users at LANL. Usage, therefore, will remain within a fairly tight range among the alternatives. The related aspect of wastewater discharges is also within a narrow range for that reason. Outfall flows range from 218 to 278 million gallons (825 to 1,052 million liters) per year across the alternatives, and these flows are not expected to result in substantial changes to existing surface or groundwater quantities. Outfall flows are not expected to result in substantial surface contaminant transport under any of the alternatives. Although mechanisms for recharge to groundwater are highly uncertain, it is possible that discharges under any of the alternatives could result in contaminant transport in groundwater, particularly beneath Los Alamos Canyon and Sandia Canyon and off site. (The outfall flows associated with the Expanded Operations and Greener Alternatives would reflect the largest potential for such contaminant transport, and the flows associated with the Reduced Operations Alternative would have the least potential for such transport.)

3.6.2.4 *Air Quality*

Nonradioactive hazardous air pollutants would not be expected to degrade air quality or affect human health under any of the alternatives. The differences across the alternatives do not result in large changes in chemical usage. The activities at LANL are such that large amounts are not typically used in any industrial process (as may be found in manufacturing facilities); but research and development activities involving many users dispersed throughout the site are the norm. Air emissions are therefore not expected to change by a magnitude that would, for example, trigger more stringent regulatory requirements or warrant continuous monitoring. Radioactive air emissions change slightly, but are within a narrow range due to the controls placed on these types of emissions and the need to assure compliance with regulatory standards. The collective population radiation doses from these emissions range from about

11 person-rem per year to 33 person-rem per year across the alternatives (primarily from LANSCE and high explosives testing activities), and the radiation dose to the maximally exposed individual ranges from 1.9 millirem per year to 5.4 millirem per year across the alternatives (primarily from the operations at the LANSCE facility). These doses are considered in the human health impact analysis.

3.6.2.5 *Ecological and Biological Resources*

No significant adverse impact to these resources is projected under any of the alternatives. The separate analyses of impacts to air and water resources constitute some of the source information for analysis of impacts in this area; as can be seen from those presentations, the variation across the alternatives are not of a sufficient magnitude to cause large differences in effects. The impacts of the Expanded Operations Alternative differ from those of the other alternatives in that there is some projected loss of habitat; however, this habitat loss is small (due to limited new construction) compared to available similar habitat in the immediate vicinity, and no significant adverse effects to ecological or biological resources are expected.

3.6.2.6 *Human Health*

The total radiological doses over the next 10 years to the public under any of the SWEIS alternatives are relatively small, as compared to doses due to background radiation in the area (about 0.3 rem per year) and would not be expected to result in any excess latent cancer fatalities (LCFs) to members of the public. Additionally, exposure to chemicals due to LANL operations under any of the SWEIS alternatives are not expected to result in significant effects to either workers or the public. Exposure pathways associated with the traditional practices of communities in the LANL area (special pathways) would not be expected to result in human health effects under any of the alternatives. The annual collective radiation dose to workers at LANL ranges from 170 person-rem per year to 830 person-rem per year across the SWEIS alternatives (the difference is primarily attributable to the differences in LANSCE accelerator operations and TA–55–4 actinide processing and pit fabrication activities); these dose levels would be expected to result in from 0.07 to 0.33 excess LCFs per year of operation, respectively, among the exposed workforce. These impacts, in terms of excess LCFs per year of operation, reflect the numbers of excess fatal cancers estimated to occur among exposed members of the workforce over their lifetimes, per year of LANL operations. The reader should recognize that these estimates are intended to provide a conservative measure of the potential impacts to be used in the decision-making process and do not necessarily portray an accurate representation of actual anticipated fatalities. In other words, one could expect that the stated impacts form an upper bound, and that actual consequences could be less but probably would not be worse. Refer to appendix D, section D.1 (in volume III), for a discussion on the determination and application of risk factors for excess LCFs.

Worker exposures to physical safety hazards are expected to result in from 417 (Reduced Operations) to 507 (Expanded Operations) reportable cases each year; typically, such cases would result in minor or short-term effects to workers, but some of these incidents could result in long-term health effects or even death.

3.6.2.7 *Environmental Justice*

Executive Order 12898 (*Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*) requires every federal agency to analyze whether its proposed action and alternatives would have disproportionately high and adverse impacts on minority or low-income populations. Based on the analysis of other impact areas, DOE expects few high and adverse impacts from the continued operation of LANL under any of the alternatives, and, to the extent impacts may be high and adverse, DOE expects the impact to affect all populations in the area equally. DOE also analyzed human health impacts from exposure through special pathways, including ingestion of game animals, fish, native vegetation, surface waters, sediments, and local produce; absorption of contaminants in sediments through the skin; and inhalation of plant materials. The special pathways have the potential to be important to the environmental justice analysis because some of these pathways may be more important or viable for the traditional or cultural practices of minority populations in the area. However, human health impacts associated with these special pathways also would not present disproportionately high and adverse impacts to minority or low-income populations.

3.6.2.8 *Cultural Resources*

Under all of the SWEIS alternatives there is a negligible to low potential for impacts to archaeological and historic resources due to shrapnel and vibration caused by explosives testing and contamination from emissions. Logically, potential impacts would vary in intensity in accordance with the frequency of explosives tests and the operational levels that generate emissions (e.g., Reduced Operations would reflect the lowest potential, and Expanded Operations would reflect the highest potential). Recent assessments of prehistoric resources indicate a low potential compared to the effects of natural conditions (wind, rain, etc.). In addition to these potential impacts, the Expanded Operations Alternative includes the expansion of the LLW disposal site at TA–54, which contains several National Register of Historic Places (NRHP) sites; it is anticipated that a determination of no adverse effect to these resources would be achieved based on a data recovery plan.

The potential impacts to specific traditional cultural properties (TCPs) would depend on their number, characteristics, and location. Such resources could be adversely affected by changes in water quality and quantity, erosion, shrapnel from explosives testing, noise and vibration from explosives testing, and contamination from ongoing operations. Such impacts would vary in intensity in accordance with the frequency of explosives tests and the operational levels that generate emissions (e.g., Reduced Operations would reflect the lowest intensity, and Expanded Operations would reflect the highest intensity). The current practice of consultation with the four Pueblos nearest to LANL would continue to be used to provide opportunities to avoid or minimize adverse impacts to any TCPs located at LANL.

3.6.2.9 *Socioeconomics, Infrastructure, and Waste Management*

LANL employment (including employees of the University of California, Johnson Controls, Inc., and Protection Technology of Los Alamos) ranges from 9,347 (Reduced Operations) to 11,351 (Expanded Operations) FTEs across the alternatives, as compared to 9,375 LANL FTEs in 1996. These changes in employment would result in changes in the Tri-County population, employment, personal income, and other socioeconomic measures. These secondary effects would change existing conditions in the Tri-County area by less than 5 percent.

Peak electrical demand under the Reduced Operations Alternative exceeds supply during the winter months and may result in periodic brownouts. Peak electrical demand under the No Action, Expanded Operations, and Greener Alternatives exceeds the power supply in winter and summer; this may result in periodic brownouts. (Power supply to the Los Alamos area has been a concern for a number of years, and DOE continues to work with other users in the area and power suppliers to increase this supply.) Natural gas demand is not projected to change across the alternatives, and this demand is within the existing supply of natural gas to the area; however, the age and condition of the existing supply and distribution system will continue to be a reliability issue for LANL and for residents and other businesses in the area. Water demand for LANL ranges from 602 million gallons (2,279 million liters) per year to 759 million gallons (2,873 million liters) per year across the alternatives; the total water demand (including LANL and the residences and other businesses and agencies in the area) is within the existing DOE rights to water.

LANL chemical waste generation ranges from 3,173 to 3,582 tons (2,878,000 to 3,249,300 kilograms) per year across the alternatives. LANL LLW generation, including LLMW, ranges from 338,210 to 456,530 cubic feet (9,581 to 12,873 cubic meters) per year across the alternatives. LANL TRU waste generation, including mixed TRU waste, ranges from 6,710 to 19,270 cubic feet (190 to 547 cubic meters) across the alternatives. Disposal of these wastes at on-site or off-site locations is projected to constitute a relatively small portion of the existing capacity for disposal sites; disposal of all LANL LLW on site would require expansion of the LLW disposal capacity beyond the existing footprint of TA–54 Area G under all alternatives (although this is only included in the Expanded Operations Alternative).

Contaminated space in LANL facilities would increase by about 63,000 square feet (5,853 square meters) under the No Action, Reduced Operations, and Greener Alternatives (due primarily to actions previously reviewed under NEPA but not fully implemented at the time the existing contaminated space estimate was established [May 1996]). The Expanded Operations Alternative would increase contaminated space in LANL facilities by about 73,000 square feet (6,782 square meters). The creation of new contaminated space implies a cleanup burden in the future, including the generation of radioactive waste for treatment and disposal; the actual impacts of such cleanups are highly uncertain because they are dependent on the actual characteristics of the facility, the technologies available, and the applicable requirements at the time of the clean-up actions.

3.6.2.10 *Transportation*

Incident-free transportation associated with LANL activities over the next 10 years would be conservatively expected to cause radiation doses that would result in about one excess LCF to a member of the public and two excess LCFs to members of the LANL workforce over their lifetimes under each of the SWEIS alternatives. (Refer to the discussion of the limitations on quantitative estimates of excess LCF risks in volume III, appendix D.) There is little variation in impacts because effects are small, and the increased transport of radioactive materials is not enough to make a significant change in these small effects.

Transportation accidents without an associated cargo release over the next 10 years of LANL operations are conservatively projected to result in from 33 to 76 injuries and 3 to 8 fatalities (including workers and the public) across the alternatives. The bounding off-site and on-site transportation accidents over the next 10 years involving a release of cargo would not be expected to result in any injuries or fatalities to members of the public for any of the alternatives. Accidents were analyzed by type of material, and the maximum quantities were selected for analysis. These parameters do not change across the alternatives. Total risk also does not change appreciably across the alternatives, because the frequency of shipments dose not vary enough to substantially influence the result.

3.6.2.11 *Accidents (Other Than Transportation Accidents and Worker Physical Safety Incidents/Accidents)*

Accidents were analyzed by creating scenarios, ranging from probable to highly improbable, that would demonstrate the effects of abnormal circumstance on existing and proposed operations. Such scenarios were selected based on screening steps that would select for demonstration those scenarios that involved the greatest quantities of hazardous material and the most severe circumstances, or that might involve a typical operation with a hazardous material. The purpose of analyzing a variety of scenarios was to provide some perspective on risks associated with operating LANL, and not to provide a list of all the possible things that could reasonably be expected to go wrong. Variations in operations across the alternatives did not change these scenarios because there are few changes in factors that would influence this type of analysis, such as significant changes in quantities of materials involved in an operation, toxicity of material, or new physical hazard.

The operational accident analysis included four scenarios that would result in multiple source releases of hazardous materials: three due to a site-wide earthquake and one due to a wildfire. (Three different earthquake magnitudes were analyzed [labeled SITE–01, SITE–02, and SITE–03], resulting in three different degrees of damage and consequences and one wildfire scenario [labeled SITE–04].) These four scenarios dominate the radiological risk due to accidents at LANL because they involve radiological releases at multiple facilities and are considered credible (that is, they would be expected to occur more often than once in a million years), with the wildfire considered likely. Another earthquake-initiated accident, labelled RAD–12, is facility-specific (to Building TA–16–411) and is dominated by the site-wide earthquake accidents due to its very low frequency (about 1.5 x 10^{-6} per year). It is noteworthy that the consequences of such earthquakes are dependent on the frequency of the earthquake event, the facility design, and the amount of material that could be released due to the earthquake; such features do not change across the SWEIS alternatives, so the impacts of these accidents are the same for all four alternatives. Similarly, the site-wide wildfire risks do not change significantly among the alternatives because the alternatives do not affect the probability (frequency) of the wildfire. The risks were estimated conservatively in terms of both the frequency of the events and the consequences of such events. (In particular, it is noteworthy that the analysis assumes that any building that would sustain structural or systems damage in an earthquake scenario does so in a manner that creates a path for release of material outside of the building.) Similarly, the wildfire analysis assumes that any building that is vulnerable to wildfire and in the path of the wildfire will burn. The total societal risk of an accident is the product of the accident frequency and the consequences to the total population within 50 miles (80 kilometers). This risk as presented in chapter 5 and appendix G (in volume III), ranges from 0.046 (SITE–01) and 0.034 (SITE–04) excess LCF per year of operation, to extremely small numbers for most of the radiological accidents.[1] The societal risk for release of chemicals, such as chlorine, is calculated similarly as the product of the frequency and numbers of people exposed to greater than the selected guideline concentration, Emergency Response Planning

1. As an example, for SITE–01 the societal risk of 0.046 excess LCF per year was calculated by multiplying the event frequency of 0.0029 per year by the consequence to the population of 16 excess LCFs (Table 3.6.2–2). The excess LCFs resulting from public exposure are calculated by an approved model, such as the MELCOR Accident Consequences Code System (MACCS) code, or alternatively by multiplying the public exposure of 27,726 person-rem (from accident analysis) by the conversion factor of 5 x 10^{-4} excess LCFs per person-rem (ICRP 1991).

Guideline (ERPG–2)[2]. The risks for chemical releases range from 6.4 (SITE–01) people exposed per year of operation to vanishingly small numbers for some chemical releases. In general, such earthquakes would be expected to cause fatalities due to falling structures or equipment; this also would be true for LANL facilities. Thus, worker fatalities due to the direct effects of the earthquakes would be expected. Worker injuries or fatalities due to the release of radioactive or other hazardous materials would be expected to be small or modest increments to the injuries and fatalities due to the direct effects of the earthquakes.

Often, there are no differences between accident impacts among the alternatives, largely as a result of conservative approaches used in accident frequency and public consequence. The inventories used in the analyses are typically those of permitted or administrative limits (i.e., controls on the maximum amounts of material that can be processed at one time and/or in storage), rather than operational values (i.e., the actual amount of material needed to perform the task). The operational values would be more likely to change among the alternatives. The administrative limits or inventories are selected so that the analyses are sufficiently conservative and bounding to cover maximum possible operational values. The accident frequencies depend upon the accident initiators, such as an aircraft crash, earthquake, or wildfire. These particular initiators are independent of the operations and of inventory; therefore, the frequency or likelihood of such an event remains constant among the alternatives. In the few cases of accidents in which the frequency depends upon operations, the variation in frequency among the alternatives does not necessarily translate into a significant change in the risk of an environmental release to the public because the value of a release is very small. Likewise, the risk to workers is affected by the change in frequency of the operations; but, the consequence of a single accident remains the same.

Plutonium accident risks to the public (other than those associated with the site-wide earthquake scenarios) are dominated by the puncture of a "typical" TRU waste drum (typical refers to the radioactivity of the drum contents), which is the highest frequency plutonium accident analyzed, and the release of plutonium from a fire in a TRU waste container storage area, which had one of the highest population doses from a plutonium accident. These accidents, labeled as RAD–09 and RAD–07, have societal risks of 0.0008 and 0.00011 excess LCF per year, respectively, under the No Action Alternative. While other accident scenarios were considered and analyzed (including process risks in TA–55 and the CMR Building), their risks to the public are at least an order of magnitude lower because either they are associated with relatively infrequent initiating events (e.g., aircraft crashes), or because the event occurs within facilities that are designed with multiple features (referred to as defense in depth) that prevent or minimize releases to the public. The risks associated with plutonium accidents change slightly (less than an order of magnitude) across the SWEIS alternatives. (Frequency or consequence increases [up to double that of No Action] for some accidents under the Expanded Operations Alternative, and frequency decreases [by up to 25 percent] from some accidents under the Reduced Operations Alternative.) RAD–07 and RAD–09 remain the dominant plutonium accidents under all alternatives.

Worker risk due to plutonium accidents is highly dependent on the number of workers present at the time of the event, on the type of protective measures taken at the time of the accident, on the speed with which these measures are taken, and on the effectiveness of

2. ERPG–2 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without irreversible or serious health effects or symptoms that could impair their abilities to take protective action.

medical treatment after exposure; as such, worker risks cannot be predicted quantitatively or reliably. In general, worker risks due to plutonium released in an accident would be limited to those workers in the immediate vicinity of the accident, and the consequences would be an increased risk of excess LCFs due to inhalation of plutonium; any acute fatalities would only be expected due to the initiating event (e.g., an aircraft crash), not due to the plutonium release. Worker risks change across alternatives only to the extent that frequencies of the events change (as discussed above for public risk from plutonium accidents).

An overview of the 1969 plutonium pit fire at the Rocky Flats site and a comparison of the design and operational differences between Rocky Flats and TA–55–4 are presented in appendix G, section G.4.1.2. Substantial differences exist between the nuclear facility and operations being conducted in TA–55–4 today and those that were present at the Rocky Flats Plant in 1969. TA–55–4 was designed to correct the deficiencies detected in older facilities such as the Rocky Flats Plant and is being upgraded to meet the even more stringent requirements of the 1990's, including enhanced seismic resistance and fire containment.

The risks to the public associated with highly enriched uranium (labeled as RAD–03) and tritium (RAD–05) releases due to accidents, other than the site-wide earthquakes, are several orders of magnitude lower than those for the earthquake or for the plutonium accidents. Similarly, worker risks in such accidents are also substantially lower for these types of accidents (as compared to the worker risks for site-wide earthquake or plutonium accident events). The risks to the public and to the workers associated with highly enriched uranium and tritium releases do not change across the alternatives because the frequencies of the initiating events and the amounts of material involved in the accident do not change across the alternatives.

The risk to the public from accidents that result in chemical releases (due to events other than the site-wide earthquakes and wildfire) at LANL dominate all other accident risks. In particular, the release of chlorine gas from TA–55 (labeled as CHEM–06) has a relatively high frequency and substantial consequences. The societal risk for this accident is about six people per year who would be exposed to greater than ERPG–2 concentrations of chlorine. The site-wide wildfire also can release some chemicals that would be released by earthquakes. Because the frequency of the wildfire is much greater than that of earthquakes, SITE–04 has a societal risk of 1.1 people per year exposed to greater than ERPG–2 concentrations of formaldehyde. Three other accidents that result in chemical releases (CHEM–01, CHEM–02, and CHEM–03) have societal risks that are very similar to the risks associated with hazardous chemical releases from the site-wide earthquakes (up to 0.066 people per year exposed to greater than ERPG–2 concentrations of chlorine gas for CHEM–01). It is noteworthy that the scenario for CHEM–01 is associated with potable water treatment activities; such activities are typical of municipal water supply operations throughout the U.S. It is also noteworthy that the LANL potable water treatment process is being changed to a process that does not require that quantities of chlorine gas be stored for use. The risk associated with CHEM–06 would not be expected to change across the SWEIS alternatives; CHEM–01 and CHEM–02 have slight changes in risk across the alternatives (up to a 14 percent increase and an 8 percent decrease for CHEM–02) due to the operational changes (which change the frequencies of these accidents) associated with the Expanded Operations Alternative and the Reduced Operations Alternative.

As with other worker accidents discussed above, the risk of worker injury or fatality due to these chemical release accidents is highly dependent on whether workers are present at the time of the accident, the protective measures taken, how quickly protective measures are taken, and the effectiveness of medical treatment after the event. For CHEM–01, CHEM–03, and CHEM–06, it is unlikely that workers would be in the area at the time of the event (if workers were present, there is potential for worker injury or fatality). For CHEM–02, the fire and the chlorine release would be visible, and escape is likely for any workers present; if workers present do not escape, injury or fatality is possible. For CHEM–04 and CHEM–05, four or five workers are typically in the area during working hours; workers present could be injured or killed by missiles from the cylinder rupture or from exposure to the toxic gas. Workers risks change across alternatives only to the extent that frequencies of the events change (as discussed above for public risk from chemical release accidents).

In addition to the discussions of worker risks for the accidents discussed above, four other accidents were analyzed specifically for potential risk to workers (these would not be expected to result in substantial risks to the public). Of the worker accidents analyzed (recalling that transportation and physical safety hazards are discussed separately in sections 3.6.2.10 and 3.6.2.6, respectively), the highest frequency worker accidents would be associated with a biohazard contamination (WORK–02) or with an inadvertent exposure to nonionizing radiation (WORK–04); these would be expected to result in injury or fatality to one worker. Multiple worker injuries or fatalities are possible from either an inadvertent high-explosives detonation (WORK–01) or from an inadvertent nuclear criticality event (WORK–03). Risks to workers under any of these scenarios would not be expected to change across the SWEIS alternatives.

3.6.3 Project-Specific Consequences

This section summarizes the impacts of the proposed expansion of LLW disposal in Area G (included in both the Preferred Alternative and the Expanded Operations Alternative) and the proposed enhancement of plutonium pit manufacturing operations (included only in the Expanded Operations Alternative), including siting and construction, as well as operational impacts, once construction is completed. The impacts reflected here are a portion of the impacts associated with the Expanded Operations Alternative (DOE’s Preferred Alternative, with the exception that pit manufacturing would not be implemented at a 50 pits per year level, single shifts, but only at a level of 20 pits per year).

3.6.3.1 *Expansion of TA–54/Area G Low-Level Radioactive Waste Disposal Area*

The disposal of LLW in excavated disposal cells at LANL has been ongoing at Area G for a number of years. At this time, it appears that the disposal space remaining in the existing footprint at Area G will be exhausted within the next 10 years. The SWEIS examines the potential solutions to disposal of LLW through shipment off the site to the extent possible, use of the existing space to maximum capacity and shipment of the remaining waste to off-site locations, and expansion of LLW disposal space at LANL to accommodate on-site disposal for the foreseeable future.

As discussed in volume II, part I, expansion could be achieved by expansion of the existing disposal site at TA–54 (different TA–54 expansion options are considered), or by expansion into a new disposal site (TA–67 is examined as representative of such sites because it is the best characterized “new” site for such purposes). Expansion into Zones 4 and 6 at TA–54 is DOE's PSSC Preferred Alternative.

Land Resources

Alternatives for the development of additional disposal capacity on site involve from approximately 40 to 72 acres (16 to 29 hectares) depending on location. Locations on Mesita del Buey involve areas that have historically been designated for waste management activities, while use of the TA–67 site would be a new land use designation. All sites present physical constraints on development of some type, such as required set backs from canyon rims and location of power lines, although the sites closest to existing disposal areas must also avoid monitoring exclusion zones established for investigations under the ER Project. Sites in the Zones 4 and 6 locations are closest to existing waste disposal activities. There would be no changes in visibility of any new site from current operations for any location other than TA–67. In that case, there would be increased visibility from Pajarito Road. As is currently the case, disposal cell excavation activities could slightly exceed background noise levels at the nearest residential area (White Rock) for all sites except the one at TA–67.

Geology and Soils

All new sites involve the same types of surface soils and the same underlying Bandelier Tuff as the current disposal site. There is evidence that TA–67 may have a geologic fault. Disposal activities would not be expected to cause seismic activity or change soil erosion or geology in the area; this is due in part to the practice of revegetating the land after a disposal cell is filled and closed. These activities are not expected to contribute substantially to soil contamination in the area; this is due in part to the geology in the area and disposal and closure practices intended to isolate the buried waste from interacting with the environment.

Water Resources

There are no differences among on-site disposal alternatives in this resource area. Activities are not expected to use large quantities of water. Additionally, current and planned disposal practices (e.g., isolation of the closed disposal cells) minimize the potential for water to run across the site and to transport contaminants. The geology in the area is also expected to contribute to the minimal transport of contaminants to either the surface or groundwater bodies in the area.

Air Quality

Short duration dust from excavation and diffuse emissions (mostly from open disposal cells) will be similar to recent historical experiences (which have not had any substantive effect on air quality), although road development for the TA–67 site would cause additional short-term dust and vehicle exhaust emissions. Additionally, if cleared trees are burned, the smoke would have a temporary effect on air quality. Finally, it is possible that excavation in Zone 4 could disturb a volatile organic compound plume from Area L, resulting in low concentration releases; it is expected that this plume would be avoided during excavation.

Ecological Resources

Total acreage disturbed is greatest for the TA–67 alternative because of the need for new road and infrastructure development, while the Zone 4 and 6 alternatives involve the least disturbance. Because the habitat is similar for all the on-site development alternatives, the extent of habitat loss is also greatest at the TA–67 site, and least at the Zone 4 and 6 locations. The habitat change is expected to be relatively small under any of the PSSC alternatives, and similar habitat is available in the immediate area at both TA–54 and TA–67. This loss of habitat is not likely to affect species in the area. Loss of foraging habitat for peregrine falcons is less than 0.1 percent of the area's potential for all alternatives, except for the TA–67 alternative (where it would be about 1.3 percent). Loss of roosting area for the Mexican spotted owl is also identified for the TA–67 alternative.

Human Health

There are no significant differences in this area among the PSSC alternatives, but effects on human health do potentially arise from operating the expanded waste disposal area. Worker health risks associated with LLW disposal range from radiation exposure (much less for individuals than the DOE radiation exposure standard) to occupational safety and health incidents and accidents related to excavation of disposal cells and equipment operations. These are similar in nature to existing worker health risks; however, the projected waste generation across LANL is higher under the Expanded Operations Alternative, so these worker impacts are slightly greater than have been experienced in recent history and greater than would be expected under the SWEIS No Action Alternative.

In general, public health impacts in the near term would be similar to those experienced in recent years due to effects on soil, water, and air quality; as discussed above, these are minimal (LANL 1998). The Area G Performance Assessment indicates that over the next 1,000 years the maximum health impacts to the public would be minimal (e.g., exposure from all pathways in White Rock and Pajarito Canyon is less than 0.1 millirem per year; exposure from all pathways in Cañada del Buey is less than 6 millirem per year).

Environmental Justice

Expansion of LLW disposal is not likely to result in disproportionately high nor adverse impacts to minority and low-income populations.

Cultural Resources

Up to 15 known archeological sites could be affected by excavation activities at the Zone 4 and 6 locations, with the fewest known sites (4) potentially affected at the North Site location. Data recovery plans and consultations would be needed under all PSSC alternatives. (These have been completed for Zone 4.) It is expected that existing policies and procedures at LANL would minimize impacts by avoiding these sites, where possible. Where sites cannot be avoided, existing procedures call for data recovery in consultation with the New Mexico State Historic Resources Office(r) and others, where appropriate. If TCPs are present in areas of excavation, they would either be destroyed by construction or diminished in value.

Socioeconomics, Infrastructure, and Waste Management

All alternatives for developing additional waste disposal areas require minimal additional workers (30 more, or about a 15 percent increase above the No Action Alternative levels for solid waste management operations). Additionally, these activities do not demand substantial amounts of water, electricity, or gas. Finally, the generation of secondary waste is attributed primarily to treatment, storage, and repackaging operations, not to waste disposal; thus, secondary waste generation would not be expected to change substantially.

Transportation

The SWEIS Expanded Operations Alternative (with on-site disposal) would increase on-site shipments substantially—to almost double the approximately 1,300 shipments per year under the No Action Alternative (due to greater waste generation under the Expanded Operations Alternative and the shipment of LLW off the site under the No Action Alternative). However, due to the low radionuclide concentrations in LLW, the relatively short distances travelled on site, and the low rate of accidents experienced for on site shipments, this large difference in shipments does not equate to large differences in on-site transportation impacts (on-site transportation impacts under either the Expanded Operations or No Action Alternatives result in far less than one fatality or injury over the next 10 years due to traffic accidents and radiation doses related to such shipments), and waste shipments do not influence the bounding cargo accident risks.

In contrast, development and use of additional disposal capacity on site would reduce the off-site shipments of waste, as compared to the No Action Alternative (410 off-site LLW shipments per year under No Action Alternative, as compared to 33 under Expanded Operations). Again, the low concentrations of radionuclides in LLW would mean that these shipments contribute very little to incident-free radiation doses, and they do not bound the off-site cargo accident risk. While the longer off-site transportation mileage results in greater risks of vehicle accidents, injuries, and deaths, these are similar to the risks of increasing any vehicular traffic and are not unique to the fact that these are radioactive waste shipments. The off-site LLW shipments are a relatively small percentage of the total off-site shipment mileage under either the SWEIS No Action Alternative or the Expanded Operations Alternative.

Accidents

Accident risk associated with waste disposal operations for all alternatives are essentially the same. This is because the accident frequencies are relatively insensitive to the differences in waste volumes across the alternatives and because the consequences of an accident are dependent on the amount of material involved in the accident (which changes very little across the alternatives), not the total amount of generated or disposed waste. An additional factor is that waste disposal requires comparable packaging, handling, and certification in accordance with WAC whether it is disposed of on or off the site.

3.6.3.2 *Enhancement of Plutonium Pit Manufacturing*

The implementation of the plutonium pit production mission is examined in the SWEIS at varying levels. The No Action Alternative for operations includes the manufacturing of pits at a maximum rate of about 14 pits per year under the Expanded Operations Alternative, and as discussed in volume II, part II, DOE is considering the enhancement of the existing capability to optimize processes and remove process "choke" points to allow for production of up to 50 pits per year under single shift operations (80 pits per year under multiple-shift operations). However, the DOE does not propose to implement pit manufacturing capability beyond a level of 20 pits per year in the time frame of analyses for the SWEIS. The Preferred Alternative would only implement pit manufacturing at the 20 pits per year level in the near term. This postponement does not modify the long-term goal announced in the ROD for the SSM PEIS (up to 80 pits per year using multiple shifts). Nevertheless, the impacts of full implementation of the enhancement of plutonium pit manufacturing PSSC is included in the Expanded Operations Alternative. The DOE used the "CMR Building Use" Alternative to bound the impact analysis. Because other activities in TA–55 cannot be discontinued to make space available for the enhancement and operation, TA–55 does not have enough plutonium laboratory space available to undertake this and all other TA–55 activities described under the Expanded Operations Alternative. Options (alternatives) for providing the additional space required to accommodate Expanded Operations, including pit production, are discussed in detail in volume II, part II. Under the PSSC "CMR Building Use" Alternative for providing this additional space, some existing activities at TA–55–4 would be moved over to available space in the CMR Building, thus freeing space in TA–55–4 to accommodate pit production. This would take place in a phased manner.

First, the existing capability would be increased to capacity of 20 pits per year; after that, the additional modifications would be made to achieve the 80 pits per year capacity (using multiple shifts).

The increased pit production will require additional transportation of materials between TA–55 and the CMR Building (at least an increase in transportation of samples, but potentially, the additional transportation of plutonium for CMR activities transferred from TA–55–4); DOE is proposing to construct a dedicated road to minimize impacts (road closures and accidents) to the public. Under the Preferred Alternative, these processes would not be moved to the CMR Building nor would the transportation corridor be built.

Land Resources

All project alternatives other than the No Action Alternative require the use of additional land, including land that would be used for an optional dedicated transportation corridor between TA–55 and TA–3. While the land disturbed under the "CMR Building Use" Alternative would be limited to that associated with the transportation corridor, the Brownfield and TA–55–4 Add-On Alternatives would each require about one additional acre, both of which are in developed areas of TA–55. The 7 acres (2.8 hectares) required for the optional transportation corridor have been disturbed previously but not developed. Fencing and security lighting along the road could result in visual impacts. There would be some short-duration increase in noise during construction of the road; once the road is constructed, traffic noise would not be substantially different from the existing traffic noise in the area. (Under the Preferred Alternative, the road would not be constructed to establish the 20 pits per year capability, and the impacts associated with construction of that road would not be incurred.) Increased noise levels due to construction activity at TA–55 would occur under any of the PSSC alternatives. In addition, the "CMR Building Use" Alternative would result in increased construction noise at TA–3.

Geology and Soils

No changes in geology or soils are anticipated for either construction or operations under any PSSC alternative.

Water Resources

Minimal increase in water use is anticipated for either construction or operations under any of the PSSC alternatives. Some increases in RLW generation (associated with all activities under this alternative; pit production activities are not substantial contributors to this waste stream) would also be anticipated (a maximum increase of 2.6 million gallons [10 million liters] per year above the No Action Alternative level of about 6.6 million gallons [25 million liters] per year) under any of the PSSC alternatives. The location for wastewater discharge does not change from that under the SWEIS No Action Alternative.

Air Quality

The only potential construction air quality impacts are related to the emissions from construction equipment; these emissions would not exceed regulatory standards for criteria pollutants and would not be expected to affect air quality beyond the immediate vicinity of the construction work.

Operations under the "CMR Building Use" PSSC alternative in TA–55–4 and the CMR Building directly related to the implementation of pit production at LANL would result in minor increases in radioactive air emissions. For the CMR Building, an increase of 38 microcuries per year is attributable to pit production activities. (The total difference between the No Action and Expanded Operations radioactive air emissions at the CMR Building is about 340 microcuries per year.) For TA–55, a net increase (considering pit manufacturing increases and decreases due to activities moved to the CMR Building) of about 9 microcuries per year is attributable to pit production activities. (The total difference between the No Action and Expanded Operations radioactive air emissions at TA–55 is about 11 microcuries per year.) Under the other PSSC alternatives, the radioactive air emissions would not increase as much at the CMR Building, but most of the total 47 microcuries in increased annual air emissions attributed to pit production in both facilities would occur at TA–55. At the 20 pits per year production rate (Preferred Alternative), radioactive air emissions for TA–55 and the CMR Building together would result in about a 20 microcuries per year increase due to pit production activities; the radioactive air emissions impacts under the Expanded Operations Alternative at this rate would be essentially the same as those presented under the "CMR Building Use" Alternative. No substantive changes in nonradioactive air emissions are expected due to these activities under any of the PSSC alternatives.

Ecological Resources

Construction of the dedicated access road under any of the PSSC alternatives would disturb about 7 acres (2.8 hectares) and would reduce peregrine falcon foraging and meadow jumping mouse habitats by this amount. Other potential effects include:

- Large mammals (bear, elk, deer, mountain lion, coyotes) could be restricted from accessing the land in the transportation corridor and transversing to lands beyond the corridor; this access restriction could also alter predator-prey associations, food use, and habitat use in the project area.
- Potential for increases in automobile/ animal collisions could result from elk and deer movement into areas these animals do not usually inhabit.

Only minimal changes in potential habitat would be associated with alternatives requiring construction at TA–55 or TA–3. The total loss of 7 (for the "CMR Building Use" Alternative) to 8 (for the other two alternatives) acres (2.8 to 3.2 hectares) of habitat is small compared to that available on the entire LANL site. (Under the Preferred Alternative, at the 20 pits per year rate, these impacts would not be incurred because the road would not be constructed.) No other ecological impacts from operations are anticipated.

Human Health

Occupational exposure to radioactive material during the construction and modification of existing nuclear facility space for the "CMR Building Use" PSSC alternative is expected to result in up to 45 person-rem (0.018 excess LCF) to the involved workers. The other alternatives would have lower doses due to the reduced need for modification of existing nuclear facility spaces to accomplish the construction. Radiation doses to workers during operations that are directly related to pit production would constitute an increase of about 150 person-rem per year. (The total difference in collective dose associated with all activities at LANL between No Action and Expanded Operations is about 387 person-rem per year.) These occupational doses would not be expected to vary between the PSSC alternatives because the total work load would be the same, and the design criteria of the facilities would be the same regardless of implementation. This change in collective worker dose constitutes an incremental increase of about 0.06 excess LCF per year to the worker population involved in these activities. At the 20 pits per year rate (Preferred Alternative), worker exposures associated with pit production would be lower (about 130 person-rem per year lower than presented at the 80 pits per year rate). Thus, the worker population exposure and the estimated LCF risk associated with that exposure would be about 15 percent less than reflected for the Expanded Operations Alternative at the 80 pits per year rate.

Impacts to public health would not be expected to change substantially due to routine pit manufacturing operations. Except for transportation impacts (discussed below) and the contribution to public health impacts due to radiological air emissions, the remaining contributors to public health impacts do not change across the alternatives. As reflected in appendix B in volume III, (Table B.1.2.3–1), the radiological air emissions from TA–55 and CMR Building operations together contribute 1.005 person-rem per year and 1.853 person-rem per year under the No Action and Expanded Operations Alteratives, respectively. (The total collective public doses under these alteratives are about 14 and about 33 person-rem per year, respectively.) Of the total TA–55 and CMR Building air emissions, which lead to these collective public doses, about 1 percent of the curies emitted (under either the No Action or Expanded Operations Alternatives) are attributable to pit manufacturing, analytical chemistry support for pit manufacturing, actinide processing, and pit surveillance and disassembly activities (the activities that would be involved in the implementation of pit production at LANL under the Expanded Operations Alternative). Any variation to public health impacts between the PSSC alternatives would only be due to the differences in physical location of the air emission release points with relation to the publicly occupied areas, as discussed above in the air quality section.

Environmental Justice

Expansion of pit manufacturing is not likely to result in disproportionately high or adverse impacts to minority and low-income populations.

Cultural Resources

No impacts are anticipated under any of the PSSC alternatives due to construction or operations (prehistoric and historic sites are avoidable, and there are no known TCPs in the area).

Socioeconomics, Infrastructure, and Waste Management

Building modifications under the "CMR Building Use" PSSC alternative would employ about 221 construction workers over about a 3- or 4-year period (with peak employment for construction at 140 workers). The number of construction workers and project duration would be somewhat greater, but not substantially different for the other PSSC alternatives. Operations would increase employment by about 170 workers. (The total difference between employment under No Action and Expanded Operations is about 1,374 workers.) At the 20 pits per year rate (Preferred Alternative), construction and operations employment would be somewhat lower than reflected for the "CMR Building Use" Alternative. The employment differences are small compared to the total employment changes under the Expanded Operations Alternative. Thus, the impacts presented for the Expanded Operations Alternative are relatively insensitive to the PSSC alternatives and to the 20 pits per year phasing of pit production at LANL.

Utility use and contaminated space would not change substantially under the "CMR Building Use" PSSC alternative. The other two PSSC alternatives would require slightly more electrical power and would create about 15,000 square feet (1,400 square meters) of nuclear facility space that would be presumed as contaminated space.

Construction for the "CMR Building Use" PSSC alternative would generate about 15,100 cubic feet (426 cubic meters) of TRU waste, 10,200 cubic feet (288 cubic meters) of TRU mixed waste, 46,200 cubic feet (1,306 cubic meters) of LLW, and 1,100 cubic feet (31 cubic meters) of LLMW. The other PSSC alternatives would be expected to generate little, if any, radioactive waste (it could only be generated in equipment transfer to the new space). Pit manufacturing operations under the SWEIS Expanded Operations Alternative are not expected to generate substantial quantities of waste (as presented in the final SSM PEIS, this activity is expected to result in waste generation increases of less than 5 percent over current levels), except for TRU waste generation, which will increase from this activity by about 3,535 cubic feet (100 cubic meters) per year. (The total difference between No Action and Expanded Operations TRU waste generation is about 10,600 cubic feet [300 cubic meters] per year.) At the 20 pits per year level (Preferred Alternative), TRU waste generation would be about 530 cubic feet (15 cubic meters) per year.

Transportation

The Expanded Operations Alternative activities related to pit production would be expected to increase on-site shipments between TA–55 and the CMR Building by about 500 shipments per year (of plutonium sample solutions and plutonium metal, including components). Additionally, off-site shipments to and from Oak Ridge and Pantex are expected to increase by a total of about 50 shipments per year due to implementation of pit manufacturing at LANL. Even though the total risk is small (see Tables 3.6.2–1 and 3.6.2–2, Transportation Risks), these types of plutonium shipments are among those that bound both on-site and off-site transportation risk; additionally, such shipments are the main contributors to driver and public incident-free radiation doses. Because the portion of these shipments attributable to pit production operations is a small percentage of the total on-site (about 5 percent) and off-site (about 1 percent) shipments, transportation risks from pit production operations under the Expanded Operations Alternative are very small. Differences in shipment quantities are important contributors to the differences in transportation risk between the No Action and Expanded Operations Alternatives, although the absolute risk presented by these shipments is small. The construction of a dedicated transportation corridor between TA–55 and the CMR Building at TA–3 would further reduce risk associated with on-site shipments. At the 20 pits per year rate (Preferred Alternative), there would be somewhat fewer on- and off-site shipments in support of pit production; thus, the transportation impacts at that production rate would be slightly lower than presented for the Expanded Operations Alternative at 80 pits per year. Under the Preferred Alternative, the dedicated transportation route would not be constructed for implementation of the 20 pits per year rate.

Accidents

Accident risk associated with pit manufacturing operations (and those operations moved to the CMR Building to make space in TA–55 for pit production) are essentially the same under the No Action and Expanded Operations Alternatives. The reasons that there are such minor differences, given the differences in the number of pits manufactured, are that: accidents involving pit manufacturing activities themselves do not bound the risks associated with plutonium operations (section 3.6.2.11), although some of the support operations (e.g., waste handling and plutonium processing and recovery) are included in the set of bounding accidents analyzed; the frequencies of the bounding accidents are relatively insensitive to the number of pits manufactured (pit manufacturing activities are relatively small contributors to support operations throughputs); and, the consequences of accidents are dependent on the amount of material involved in the accident, which is relatively insensitive to the quantities of pits manufactured over a year. (That is, the difference in the number of pits produced over a year is dependent on process or room and does not change limits for the amount of material allowed to be in process at one time.) Any variation to accident risk between the PSSC alternatives would only be due to the differences in physical location of the release points with relation to the publicly occupied areas, similar to the discussion above in the air quality section.

3.6.4 Consequences of Environmental Restoration Activities

Environmental restoration activities, which include decontamination and decommissioning activities, are undertaken with the intent of reducing the long-term public and worker health and safety risks associated with contaminated sites or with surplus facilities and to reduce risk posed to ecosystems. Decisions regarding whether and how to undertake an environmental restoration action are made after a detailed assessment of the short-term and long-term risks and benefits for options specific to the site in question, and, at LANL, they are made primarily within the framework of the RCRA.

Because there are no individual or specific environmental restoration actions proposed within the scope of the SWEIS (such actions are proposed and undertaken on a time scale that is not compatible with the preparation of this SWEIS), the impact analyses regarding such actions are presented in general terms based on the experiences of the program, to date. As noted in the ecological resources and human health impact analyses in chapter 5, LANL's influence on ecological and human health risk arises primarily from the legacy of past operations in the form of contaminants that were historically deposited on land and in water. An improvement in the risk posed by the LANL site is therefore expected from the removal of some of this legacy contamination. A principal impact from restoration actions is related to the generation of waste during the cleanup or decontamination and decommissioning. The waste generated must be stored, treated, or disposed. Waste generation from the totality of future environmental restoration actions is estimated in the SWEIS, and the risks associated with the transport, treatment, storage, and disposal of this waste are included in the analyses (in particular, refer to sections 3.1.14, 3.1.15, 3.2.14, 3.2.15, 3.3.14, 3.3.15, 3.4.14, 3.4.15, 5.2.9, 5.3.9, 5.4.9, 5.5.9, and the discussion regarding the expansion of Area G in section 3.6.3.1).

The short-term risks and controls associated with the environmental restoration activities include:

- *Fugitive Dust*. This is the suspension of soil, including contaminated soil, in the air, resulting in the potential for exposure or dispersal of this material. At LANL, this potential risk is typically controlled by frequently wetting the ground at the clean-up site; this reduces the amounts of material suspended in air, and thus, the risk to human health and the environment (LANL 1996).
- *Surface Runoff*. This is the transport of contaminants from the clean-up site by surface water flow across the site. At LANL, surface runoff is controlled by flow barriers, collection of surface water, or contouring the ground such that flow off the site is precluded (LANL 1995a).
- *Soil and Sediment Erosion*. This is the transport of soil and sediment due to the force of wind and the intensity and frequency of precipitation. This potential risk is mitigated by covering clean-up sites with tarps during storm events to minimize the infiltration of water (LANL 1995a).
- *Worker Health and Safety Risks.* Environmental restoration actions have similar risks to those discussed in the human health impact analyses in chapter 5. Activities can involve heavy equipment, uneven ground (e.g., trenches), solvents and other chemicals, and other hazards of this nature. Worker health and safety risks are mitigated with work plans, safety programs, protective equipment, and similar administrative, education, and physical protection measures.

TABLE 3.6.1–1.—*Alternatives for Continued Operation of TA–55 Plutonium Facility Complex*

ACTIVITY	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Plutonium Stabilization	Recover, process, and store the existing plutonium inventory in 8 years.	Same as No Action Alternative.	Decrease processing rate of residue and place metal and plutonium oxide in interim storage without further processing. Material inventory will be processed in 10 to 15 years.	Same as No Action Alternative.
Manufacturing Plutonium Components	Production of up to 14 pits/yr.	Produce 50 to 80 pits/yr (long-term goal requires major facility modifications). Produce 20 pits/yr in initial phase (requires minor facility modifications).	Maintain technical capability to understand pit characteristics and behavior. 6 to 12 pits produced per year.	Same as Reduced Operations Alternative.
Surveillance and Disassembly of Weapons Components	Pit surveillance: Up to 20 pits/yr destructively examined and 20 pits/yr nondestructively examined.	This activity moves to the CMR Building, with up to 65 pits/yr disassembled, including up to 40 pits/yr destructively examined. 20 pits/yr would be nondestructively examined.	Same as No Action Alternative.	Disassemble up to 65 pits/yr including 40 pits/yr destructively examined; 20 pits/yr nondestructively examined.
Actinide Materials and Science Processing, Research, and Development	Demonstrate disassembly/conversion of 1 to 2 pits/day for up to 40 pits total.	Develop production disassembly capacity. Process up to 200 pits/yr, including a total of 250 pits (over 4 years) as part of disposition demonstration activities.	Same as No Action Alternative.	Expand some areas of technology development for weapon dismantlement support. Otherwise, this alternative is the same as the No Action Alternative.
	Process up to 1,000 Ci/yr plutonium-239/beryllium and americium/beryllium neutron sources.	Process neutron sources up to 5,000 curies (Ci)/yr. Process neutron sources other than sealed sources.	Process up to 500 Ci/yr neutron source materials. Maintain capabilities for neutron source processing.	Same as Expanded Operations Alternative, including processing a greater variety of sources.
	Process up to 220 pounds (100 kilograms)/yr of actinides. Process 1 to 2 pits/month (up to 12 pits/yr) through tritium separation.	Process up to 880 pounds (400 kilograms)/yr of actinides[a]. Support for hydrodynamic testing and tritium separation activities move to the CMR Building[b] at the same level of activity as the No Action Alternative.	Maintain activity in standby mode; no processing of actinides; no use of routine tritium separation.	Same as Reduced Operations Alternative.

TABLE 3.6.1–1.—*Alternatives for Continued Operation of TA–55 Plutonium Facility Complex*-Continued

ACTIVITY	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Actinide Materials and Science Processing, Research, and Development (continued)	Perform decontamination of 15 to 20 uranium components per month.	Perform decontamination of 28 to 48 uranium components per month.	Perform decontamination of 10 to 15 uranium components per month.	Same as Reduced Operations Alternative.
	Research in support of DOE actinide clean-up activities. Stabilize minor quantities of specialty items. Research and development on actinide processing and waste activities at DOE sites.	Increase research efforts, stabilize larger quantities of specialty materials, and increase technical support to other sites, including processing up to 310 pounds (140 kilograms) of plutonium as chloride salts from the Rocky Flats Environmental Technology Site (RFETS).	Maintain shelf-life efforts; decrease support to other sites.	Same as Expanded Operations Alternative.
	Prepare, measure, and characterize samples for fundamental research and development in areas such as aging, welding and bonding, coatings, and fire resistance.	Conduct plutonium research and development and support.	Same as No Action Alternative.	Same as No Action Alternative.
	Fabricate and study small amounts of nuclear fuels used in terrestrial and space reactors. Fabricate and study prototype fuel for lead test assemblies.	Fabricate and study more types and larger quantities of fuels.	Same as No Action Alternative.	Same as No Action Alternative.
	Develop safeguards instrumentation for plutonium assay.	Increase the level of safeguard instrumentation development.	Maintain safeguards instrumentation.	Same as Expanded Operations Alternative.
	Analyze samples in support of actinide reprocessing, research, and development activities.	Analyze half as many samples at TA–55. Remaining analyses move to the CMR Building.[b]	Analyze samples in support of actinide reprocessing, research, and development activities.	Analyze samples in support of actinide reprocessing, research, and development activities.
Fabrication of Ceramic-Based Reactor Fuels	Make prototype MOX fuel. Research and development on fuels.	Build MOX test reactor fuel assemblies and continue research and development on fuels.	Conduct fuel research and development.	Same as No Action Alternative.
Plutonium-238 Research, Development, and Applications	Process, evaluate, and test up to 25 kg/yr plutonium-238 to support space and terrestrial uses. Process up to 10 kg plutonium-238 from heat source and milliwatt recovery, research and development, and safety testing.	Process, evaluate, and test up to 25 kg/yr plutonium-238. Recycle residues and blend up to 18 kg/yr plutonium-238.	Process, evaluate, and test up to 7 kg/yr plutonium-238. Process up to 0.5 kg of plutonium-238 from heat source recovery.	Same as Expanded Operations Alternative.

TABLE 3.6.1–1.—*Alternatives for Continued Operation of TA–55 Plutonium Facility Complex*-Continued

ACTIVITY	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
SNM Storage, Shipping and Receiving	Store up to 7.3 tons (6.6 metric tons) SNM in NMSF; continue to store working inventory in the PF–4 vault; ship and receive as needed to support LANL activities.	Same as No Action Alternative.	Same as No Action Alternative.	Same as No Action Alternative.
	Conduct nondestructive assay on SNM at NMSF to verify identify and content of stored containers.	Same as No Action Alternative.	Same as No Action Alternative.	Same as No Action Alternative.

Note: All alternatives include refurbishment of TA–55 and renovation of the NMSF, as discussed in chapter 2 (section 2.2.2.1).

[a] The actinide activities at the CMR Building and at TA–55 are expected to total 880 pounds (400 kilograms)/yr. The future split between these two facilities is not known, so the facility-specific impacts at each facility are conservatively analyzed at this maximum amount. Waste projections that are not specific to the facility (but are related directly to the activities themselves) are only projected for the total of 880 pounds (400 kilograms)/yr.

[b] Activities assumed to transfer to the CMR Building in Expanded Operations (as discussed in volume II, part II) include:

- Pit disassembly (noted in Table 3.6.1–5 under Surveillance and Disassembly of Weapons Components)
- Pit surveillance (noted in Table 3.6.1–5 under Surveillance and Disassembly of Weapons Components)
- Actinide research and development and processing activities (noted in Table 3.6.1–5 under Actinide Research and Processing)
- Hydrodynamic testing support and tritium separations (noted in Table 3.6.1–5 under Actinide Research and Processing)

TABLE 3.6.1–2.—*Parameter Differences Among Alternatives for Continued Operation of the Plutonium Facility Complex (TA–55)*

PARAMETER	UNITS	INDEX[a]	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Radioactive Air Emissions						
Plutonium-239[b]	Ci/yr	1.7×10^{-5} [c]	1.7×10^{-5}	2.7×10^{-5}	9.2×10^{-6}	1.7×10^{-5}
Tritium in Water Vapor[n]	Ci/yr	8.2×10^{2} [d]	7.5×10^{2}	7.5×10^{1}	7.5×10^{1}	7.5×10^{1}
Tritium as a Gas[n]	Ci/yr	2.7×10^{2} [d]	2.5×10^{2}	2.5×10^{1}	2.5×10^{1}	2.5×10^{1}
NPDES Discharge[e] 03A–181	MGY (MLY)	14 (53)	14 (53)	14 (53)	14 (53)	14 (53)
Chemical Waste	lb\yr (kg/yr)	9,260[f] (4,200)	11,580 (5,250)	18,390 (8,340)	11,580 (5,250)	11,580 (5,250)
Low-Level Radioactive Waste	ft^3/yr (m^3/yr)	20,800[g] (590)	24,300 (688)	26,200[h] (741)	24,300 (688)	24,300 (688)
Low-Level Radioactive Mixed Waste	ft^3/yr (m^3/yr)	388[i] (11)	424 (12)	459 (13)	424 (12)	424 (12)
TRU/Mixed TRU Waste	ft^3/yr (m^3/yr)	3,850[j] (109)	5,650 (160)	14,500[h] (411)	3,810 (108)	5,720 (162)
Contaminated Space[k]	ft^2 (m^2)	59,600[m] (5,540)	+ 17,500 (NMSF) (1,630)	+ 17,500 (NMSF) (1,630)	+ 17,500 (NMSF) (1,630)	+ 17,500 (NMSF) (1,630)
Number of Workers	FTEs	640[l]	735	1,111	552	712

[a] Index was used as a point of reference for projecting data for the alternatives (as discussed on page 3–3). Index is NOT a consistent time period across parameters or facilities. Each parameter is footnoted with the index used.
[b] Index emissions data are based upon process knowledge and gross alpha counting; analysis of emissions for specific radionuclides was not determined. Projections for the alternatives were reported as plutonium or plutonium-239, the primary material at TA–55.
[c] Index for plutonium-239 is from 1988 to 1989.
[d] Index for tritiated water and tritium gas is from 1986.
[e] Outfall contains one process source and no storm water sources. Index is 1990 to 1995.
[f] Index is 1990 to 1991 average.
[g] Index is 1990, 1994, and 1995 average.
[h] Includes estimates of waste generated by the facility upgrades associated with Pit Fabrication.
[i] Index is average of 1990, 1994, and 1995.
[j] Index is average of 1988 to 1990.
[k] Index is Fiscal Year 1995. Data represent increments or decrements to the index.
[l] Index is Fiscal Year 1995.
[m] In addition, there are approximately 1,100 cubic feet (31 cubic meters) of contaminated ducts (see chapter 4, Table 4.9.10–1).
[n] As stated in Table 3.6.1–1 under the No Action Alternative, tritium separation activities will be carried out in TA–55; but under the Expanded Operations, Reduced Operations, and Greener Alternatives, the tritium separation activities will be moved to the CMR Building, and the operations parameters will be reduced from the No Action Alternative and remain constant in the Expanded Operations, Reduced Operations, and Greener Alternatives.
MGY = million gallons per year; MLY = million liters per year.

TABLE 3.6.1–3.—*Alternatives for Continued Operation of Tritium Facilities*

ACTIVITY	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
High-Pressure Gas Fills and Processing: WETF	Handling and processing of tritium gas in quantities of up to 3.53 oz (100 g) at WETF with no limit on number of operations per year. Capability is used approximately 25 times/yr.	Capability used approximately 65 times/yr.	Capability used approximately 20 times/yr.	Same as Reduced Operations Alternative.
Gas Boost System Testing and Development: WETF	System testing and gas processing operations involving quantities of up to 3.53 oz (100 g) at WETF. Capability is used 20 times/yr.	Capability used approximately 35 times/yr.	Capability used approximately 15 times/yr.	Same as Reduced Operations Alternative.
Cryogenic Separation: TSTA	Tritium gas purification and processing in quantities up to 7.06 oz (200 g) at TSTA. Capability used approximately 3 times/yr.	Capability used 5 to 6 times/yr.	Capability used 1 time/yr.	Same as Expanded Operations Alternative if focused on alternative energy development.
Diffusion and Membrane Purification: TSTA, TSFF, WETF	Research on tritium movement and penetration through materials. Used 2 to 3 times/ month.	Capability use increases significantly, accompanied by continuous use for effluent treatment and 6 to 8 experiments/ month.	Same as No Action Alternative.	Same as Expanded Operations Alternative, focused on waste reduction.
Metallurgical and Material Research: TSTA, TSFF, WETF	Capability involves materials research including metal getter research and application studies. Small quantities of tritium supports tritium effects and properties research and development. Contributes < 2% of LANL's tritium emissions to the environment.	This capability could be expanded, but the use of tritium would remain < 2% of LANL's tritium emissions to the environment.	Same as No Action Alternative.	Same as No Action Alternative

TABLE 3.6.1–3.—*Alternatives for Continued Operation of Tritium Facilities*-Continued

ACTIVITY	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Thin Film Loading: TSFF (WETF by 1998)	Chemical bonding of tritium to metal surfaces. Current application is for tritium loading of neutron tube targets; approximately 800 units/yr with small quantities of tritium.	Increase number of required target loading operations up to 3,000 units/yr. However, the tritium at risk quantities will not change.	Same as No Action Alternative.	Same as No Action Alternative.
Gas Analysis: TSTA, TSFF, WETF	Analytical support current capabilities. Operations estimated to contribute < 5% of LANL's tritium emissions to the environment.	Increase to support the tritium operations under this alternative. Material at risk, emissions, and other parameters are not expected to change in this measurement support activity.	Same as No Action Alternative.	Same as Expanded Operations Alternative.
Calorimetry: TSTA, TSFF, WETF	This capability provides a measurement method for tritium material accountability. Contained tritium is placed in the calorimeter for quantity measurements. This capability is used frequently, but contributes < 2% of LANL's tritium emissions to the environment.	Increase to support the tritium operations under this alternative. Material at risk, emissions, and other parameters are not expected to change in this measurement support activity.	Same as No Action Alternative.	Same as Expanded Operations Alternative.
Solid Material and Container Storage: TSTA, TSFF, WETF	Storage of tritium occurs in process systems, process samples, inventory for use and as waste.	On-site storage could increase by about a factor of 10, with most of increase occurring at WETF.	Same as No Action Alternative.	Same as No Action Alternative.

TABLE 3.6.1–4.—*Parameter Differences Among Alternatives for Continued Operation of the Tritium Facilities (TA–16 and TA–21)*

PARAMETER	UNITS	INDEX[1]	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Radioactive Air Emissions						
TA–16/WETF, Tritium Gas (HT/T2)	Ci/yr	1.73×10^{1} [b]	1.00×10^{2}	3.00×10^{2}	1.00×10^{2}	1.00×10^{2}
TA–16/WETF, Tritium Water (HTO)	Ci/yr	4.29×10^{1}	3.00×10^{2}	5.00×10^{2}	3.00×10^{2}	3.00×10^{2}
TA–21/TSTA, Tritium Gas (HT/T2)	Ci/yr	1.23×10^{1} [b]	1.00×10^{2}	1.00×10^{2}	1.00×10^{2}	1.00×10^{2}
TA–21/TSTA, Tritium Water (HTO)	Ci/yr	4.25×10^{1}	1.00×10^{2}	1.00×10^{2}	1.00×10^{2}	1.00×10^{2}
TA–21/TSFF, Tritium Gas (HT/T2)	Ci/yr	2.00×10^{2} [b]				
10-year average:	Ci/yr	NA	4.36×10^{2}	4.36×10^{2}	4.36×10^{2}	4.36×10^{2}
1996	Ci/yr	NA	3.00×10^{2}	3.00×10^{2}	3.00×10^{2}	3.00×10^{2}
1997 to 2000	Ci/yr	NA	6.40×10^{2}	6.40×10^{2}	6.40×10^{2}	6.40×10^{2}
2001 to 2005	Ci/yr	NA	3.00×10^{2}	3.00×10^{2}	3.00×10^{2}	3.00×10^{2}
TA–21/TSFF, Tritium Water (HTO)	Ci/yr	2.13×10^{2} [b]				
10-year average:	Ci/yr	NA	5.84×10^{2}	5.84×10^{2}	5.84×10^{2}	5.84×10^{2}
1996	Ci/yr	NA	4.00×10^{2}	4.00×10^{2}	4.00×10^{2}	4.00×10^{2}
1997 to 2000	Ci/yr	NA	8.60×10^{2}	8.60×10^{2}	8.60×10^{2}	8.60×10^{2}
2001 to 2005	Ci/yr	NA	4.00×10^{2}	4.00×10^{2}	4.00×10^{2}	4.00×10^{2}
NPDES Discharge[c]						
Total Discharges	MGY (MLY)	1.3 (4.92)	0.33 (1.25)	0.33 (1.25)	0.22 (0.83)	0.22 (0.83)
05S (Sewage Treatment Plant)	MGY (MLY)	0.77 (2.91)	0.00	0.00	0.00	0.00
02A-129	MGY (MLY)	0.11[d] (0.42)	0.11 (0.42)	0.11 (0.42)	0.11 (0.42)	0.11 (0.42)
03A-036	MGY (MLY)	0.02[e] (0.08)	0.00	0.00	0.00	0.00
03A-158	MGY (MLY)	0.22[d] (0.83)	0.22 (0.83)	0.22 (0.83)	0.11 (0.42)	0.11 (0.42)
04A-091	MGY (MLY)	0.22[d] (0.83)	0.00	0.00	0.00	0.00
Chemical Waste	lb/yr (kg/yr)	2,430[f] (1,100)	2,430 (1,100)	3,750 (1,700)	2,200 (1,000)	2,870 (1,300)
Low-Level Radioactive Waste	ft^3/yr (m^3/yr)	1,410[f] (40)	15,900 (450)	16,900 (480)	15,500 (440)	15,900 (450)
Low-Level Radioactive Mixed Waste	ft^3/yr (m^3/yr)	71[f] (2)	71 (2)	106 (3)	71 (2)	71 (2)
TRU/Mixed TRU Waste	ft^3/yr (m^3/yr)	0	0	0	0	0
Contaminated Space[g]	ft^2 (m^2)	19,770 (1,840)	+ 10,000 (930)	+ 10,000 (930)	+ 10,000 (930)	+ 10,000 (930)
Number of Workers	FTEs	112[h]	112	123	90	90

TABLE 3.6.1–4.—*Parameter Differences Among Alternatives for Continued Operation of the Tritium Facilities (TA–16 and TA–21)*-Continued

[a] Index was used as a point of reference for projecting data for alternatives (as discussed on page 3–3). Index is NOT a consistent time period across parameters or facilities. Each parameter is footnoted with the index used.
[b] Index data are either emission rates for 1996 or the average of emissions over the period 1992 to 1996, whichever is higher. For WETF and TSTA, 1996 estimates are used; for TSFF, the 5-year average is used.
[c] Outfalls consist of process sources only. Index is 1990 to 1995.
[d] Index is from ESH–18 measurements for NPDES permit application and from estimates based on facility operations. No specific dates for these data were provided.
[e] Index provided as representative data by facility operations personnel. No specific dates were available.
[f] Index is 1990 to 1995 average.
[g] Index Fiscal Year 1995. Data are increments or decrements to the index.
[h] Index is from Fiscal Year 1994.
NA = Not applicable; MGY = million gallons per year; MLY = million liters per year.

TABLE 3.6.1–5.—*Alternatives for Continued Operation of the Chemistry and Metallurgy Research Building (TA–3)*

ACTIVITY	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Analytical Chemistry	Sample analysis in support of a wide range of actinide research and processing activities. Approximately 5,200 samples/yr.	Provide expanded general sample analysis. Approximately 11,000 samples/yr. Includes actinide sample analysis relocated from TA–55.[a]	Same as No Action Alternative.	Same as No Action Alternative.
Uranium Processing	Activities to recover, process, and store LANL highly enriched uranium inventory by 2005.	Same as No Action Alternative, except for possible recovery of materials resulting from manufacturing operations.	Residue processing rate will decrease and highly enriched uranium will be placed in interim storage. Material inventory will be processed in 10 to 15 years.	Same as No Action Alternative.
Destructive and Nondestructive Analysis	Evaluate up to a total of 10 secondaries (an average of 1/yr) through destructive/ nondestructive analysis and disassembly.	Evaluate 6 to 10 secondaries/yr.	Same as No Action Alternative.	Same as No Action Alternative.
Nonproliferation Training	Nonproliferation training involving SNM.	Increased training, but no additional quantities of SNM. May work with more types of SNM.	Decreased training, but capability and inventory still remain.	Same as Expanded Operations Alternative.
Actinide Research and Processing	Process plutonium-238/beryllium neutron source at up to approximately 3,600 Ci/yr. Process americium-241/beryllium neutron source at up to approximately 500 Ci/yr. Stage up to 1,000 plutonium-238/ beryllium and americium-241/ beryllium sources in Wing 9 floor holes.	Process plutonium-238/beryllium and americium-241/beryllium neutron sources up to 5,000 Ci/yr at the CMR Building. Process neutron sources other than sealed sources. Stage up to 1,000 plutonium-238/beryllium and americium-241/beryllium sources in Wing 9 floor holes.	Maintain capabilities for americium-241/beryllium and plutonium-238/beryllium neutron source processing. Throughput would not exceed 2,000 Ci/yr. Stage up to 1,000 plutonium-238/ beryllium and americium-241/ beryllium sources in Wing 9 floor holes.	Same as Expanded Operations Alternative.
	Retain technical capability for research and development activities of spent nuclear reactor fuels.	Introduce research and development effort on spent nuclear fuel related to long-term storage and analyze components in spent and partially spent fuels.	Same as No Action Alternative.	Same as Expanded Operations Alternative.

TABLE 3.6.1–5.—*Alternatives for Continued Operation of the Chemistry and Metallurgy Research Building (TA–3)*-Continued

ACTIVITY	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Actinide Research and Processing (continued)	Metallurgical microstructural/ chemical analysis and compatibility testing of actinides and other metals. Primary mission to study long-term aging and other material effects. Characterize about 50 samples/yr.	Increased number of samples, with no changes in type of analyses performed. Characterize about 100 samples/yr. Conduct research and development in hot cells on pits exposed to high temperatures.	Maintain capability, characterize 25 samples/yr.	Same as No Action Alternative.
	Analysis of TRU disposal related to validation of WIPP performance assessment models. TRU waste characterization. Analysis of gas generation such as could occur in TRU waste during transportation to WIPP. Performance Demonstration Program to test nondestructive analysis/nondestructive examination equipment.	In addition to No Action activities: • Demonstrate actinide decontamination technology for soils and materials. • Develop actinide precipitation method to reduce mixed wastes in LANL effluents.	Same as No Action Alternative.	Same as Expanded Operations Alternative.
Actinide Activities Relocated from TA–55 (Expanded Operations Alternative only)		Process up to 880 lb (400 kg)/yr actinides.[a] Support to hydrodynamic testing and tritium separation activities move to the CMR Building[b] (requires facility modifications to make standby wings operational).		

TABLE 3.6.1–5.—*Alternatives for Continued Operation of the Chemistry and Metallurgy Research Building (TA–3)*-Continued

ACTIVITY	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Fabrication and Metallography	Produce 1,080 targets/yr containing approximately 0.71 oz (20 g) uranium-235 target for molybdenum-99.	Produce 1,080 targets/yr plus additional 20 targets/wk for 12 wks. Separate fission products from irradiated targets to provide molybdenum-99. Ability to produce 3,000 6-day curies of molybdenum-99/wk.	Produce 50 targets/yr and store them.	Same as No Action Alternative.
	Support complete highly enriched uranium processing research and development pilot operations and casting. Fabricate metal shapes, including up to 50 sets of highly enriched uranium components, using 2.2 to 22 lb (1 to 10 kg) highly enriched uranium/ operation. Material recovered and retained in inventory. Up to 2,200 lb (1,000 kg) annual throughput.	Same as No Action Alternative	Same as No Action Alternative.	Same as No Action Alternative.
Disassembly of Weapons Components (Relocated from TA–55, Expanded Operations Alternative only)		Disassemble approximately 65 pits/yr, including 40 pits/yr destructively examined for surveillance. More testing on the 20 pits/yr nondestructively examined[b] (requires facility modifications to make standby wings operational).		

Note: All alternatives include completion of Phase I and II Upgrades, as discussed in chapter 2 (section 2.2.2.3).

[a] The actinide activities at the CMR Building and at TA–55 are expected to total 880 lb (400 kg)/yr. The future split between these two facilities is not known, so the facility-specific impacts at each facility are conservatively analyzed at this maximum amount. Waste projections, which are not specific to the facility (but are related directly to the activities themselves), are only projected for the total of 880 lb (400 kg)/yr.

[b] Activities to be moved to the CMR Building from TA–55 in Expanded Operations Alternative include:

- Pit disassembly (noted in Table 3.6.1–1 under Surveillance and Disassembly of Weapons Components).
- Pit surveillance, which is also a disassembly operation (noted in Table 3.6.1–1 under Surveillance and Disassembly of Weapons Components).
- Actinide research and development and processing activities (noted in Table 3.6.1–1 under Actinide Reprocessing, Research, and Development).
- Hydrodynamic testing support and tritium separation activities (noted in Table 3.6.1–1 under Actinide Reprocessing, Research, and Development).

TABLE 3.6.1–6.—*Parameter Differences Among Alternatives for Continued Operation of the Chemistry and Metallurgy Research Building (TA–3)*

PARAMETER	UNITS	INDEX[a]	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Radioactive Air Emissions						
Total Actinides	Ci/yr	2.0×10^{-4} [b]	4.20×10^{-4}	7.60×10^{-4}	3.80×10^{-4}	4.20×10^{-4}
Krypton-85[c]	Ci/yr	None	None	1.00×10^{2}	None	None
Xenon-131m	Ci/yr	None	None	4.50×10^{1}	None	None
Xenon-133	Ci/yr	None	None	1.50×10^{3}	None	None
Tritium Water (HTO)[d]	Ci/yr	Negligible	Negligible	7.50×10^{2}	Negligible	Negligible
Tritium Gas (HT)[d]	Ci/yr	Negligible	Negligible	2.50×10^{2}	Negligible	Negligible
NPDES Discharge 03A–021[e]	MGY (MLY)	0.53 (2.01)	0.53 (2.01)	0.53 (2.01)	0.53 (2.01)	0.53 (2.01)
Chemical Waste	lb/yr (kg/yr)	10,500[f] (4,760)	17,600 (7,970)	24,700 (11,200)	13,000 (5,890)	18,200 (8,270)
Low-Level Radioactive Waste[g]	ft^3/yr (m^3/yr)	27,600[f] (781)	48,700 (1,380)	65,700 (1,860)	45,200 (1,280)	49,800 (1,410)
Low-Level Radioactive Mixed Waste	ft^3/yr (m^3/yr)	180[f] (5.1)	580 (16.4)	690 (19.6)	570 (16.2)	580 (16.5)
TRU/Mixed TRU Waste[g]	ft^3/yr (m^3/yr)	760[f] (21.4)	950 (26.8)	2,370 (67.0)	800 (22.8)	1,000 (28.2)
Contaminated Space[h]	ft^2 (m^2)	40,320[j] (3,750)	No change	No change	No change	No change
Number of Workers	FTEs	221[i]	329	527	299	324

[a] Index was used as a point of reference for projecting data for alternatives (as discussed on page 3–3). Index is NOT a consistent time period across parameters or facilities. Each parameter is footnoted with the index used.
[b] Index for the actinides is 1990 to 1994 average.
c Mixed fission products are only applicable for the Expanded Operations Alternative for medical isotope production.
[d] Tritium phase calculation of 75% water and 25% gas based upon 1997 data for TA–55 process to move to the CMR Building under the Expanded Operations Alternative. See Table 3.5.2.1–1.
[e] Outfall 03A–021 consists of one process source and five storm drain sources. Index is 1990 to 1995.
[f] Index is 1990 to 1995 average.
[g] Waste from the Phase II CMR Upgrades are included (e.g. 141,000 ft^3 [4,000 m^3]) in all alternatives during 1997 to 2000 (DOE 1997). Estimates in the tables are annual averages; the 141,000 ft^3 (4,000 m^3) is a total included in these averages.
[h] Index Fiscal Year 1995. Data are increments or decrements to the index.
[i] Provided as representative data by the facility subject matter expert. No specific index date available.
[j] In addition, there are approximately 760 ft^3 (21.5 m^3) of contaminated ducts (see chapter 4, Table 4.9.10–1).
MGY = million gallons per year; MLY = million liters per year.

TABLE 3.6.1–7.—*Alternatives for Continued Operations of Pajarito Site (TA–18)*

ACTIVITIES	NO ACTION[a]	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Dosimeter Assessment and Calibration	Perform criticality experiments.	Criticality experiments increase 25% above No Action Alternative.	Same as No Action Alternative.	Same as No Action Alternative.
Detector Development	Develop safeguards instrumentation and perform research and development for nuclear materials, LIDAR[b] experiments, and materials processing.	Same activities as under No Action, with increased alternative nuclear materials inventory by 20% and replace portable linear accelerator.	Same as No Action Alternative.	Same as Expanded Operations Alternative.
Materials Testing	Perform criticality experiments. Develop safeguards instrumentation and perform research and development for nuclear materials, LIDAR[b] experiments, and materials processing.	Criticality experiments increase 25% above No Action Alternative.	Same as No Action Alternative.	Same as Expanded Operations Alternative.
Subcritical Measurements	Perform criticality experiments. Develop safeguards instrumentation and perform research and development for nuclear materials, LIDAR[b] experiments, and materials processing.	Criticality experiments increase 25% above No Action Alternative. Increase alternative nuclear materials inventory by 20%.	Same as No Action Alternative.	Same as Expanded Operations Alternative.
Fast-Neutron Spectrum	Perform criticality experiments. Develop safeguards instrumentation and perform research and development for nuclear materials, LIDAR[b] experiments, and materials processing.	Criticality experiments increase 25% above No Action Alternative. Increase alternative nuclear materials inventory by 20%. Increase nuclear weapons components and materials.	Same as No Action Alternative.	Same as Expanded Operations Alternative.

TABLE 3.6.1–7.—*Alternatives for Continued Operations of Pajarito Site (TA–18)*-Continued

ACTIVITIES	NO ACTION[a]	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Dynamic Measurements	Perform criticality experiments. Develop safeguards instrumentation and perform research and development for nuclear materials, LIDAR[b] experiments, and materials processing.	Criticality experiments increase 25% above No Action Alternative. Increase alternative nuclear materials inventory by 20%.	Same as No Action Alternative.	Same as Expanded Operations Alternative.
Skyshine Measurements	Perform criticality experiments.	Criticality experiments increase 25% above No Action Alternative.	Same as No Action Alternative.	Same as No Action Alternative.
Vaporization	Perform criticality experiments.	Criticality experiments increase 25% above No Action Alternative.	Same as No Action Alternative.	Same as No Action Alternative.
Irradiation	Perform criticality experiments. Develop safeguards instrumentation and perform research and development for nuclear materials, interrogation techniques, and field systems.	Criticality experiments increase 25% above No Action Alternative. Increase alternative nuclear materials inventory by 20%.	Same as No Action Alternative.	Same as Expanded Operations Alternative.

[a] The total number of experiments under the No Action Alternative were 570 in 1997 and projected to have an annual growth of about 5% for the next 10 years.
[b] Light detection and ranging.

TABLE 3.6.1–8.—*Parameter Differences Among Alternatives for Continued Operation of the Pajarito Site, (TA–18)*

PARAMETER	UNITS	INDEX[a]	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Radioactive Air Emissions Argon-41[b]	Ci/yr	1.16×10^{c}	8.17×10^{1}	1.02×10^{2}	8.17×10^{1}	8.17×10^{1}
NPDES Discharge	MGY	No outfalls	No outfalls	No outfalls	No outfalls	No outfalls
Chemical Waste	lb/yr (kg/yr)	4,400[d] (2,000)	8,800 (4,000)	8,800 (4,000)	8,800 (4,000)	8,800 (4,000)
Low-Level Radioactive Waste	ft^3/yr (m^3/yr)	2,470[d] (70)	5,120 (145)	5,120 (145)	5,120 (145)	5,120 (145)
Low-Level Radioactive Mixed Waste	ft^3/yr (m^3/yr)	25[d] (0.7)	53 (1.5)	53 (1.5)	53 (1.5)	53 (1.5)
TRU/Mixed TRU Waste	ft^3/yr (m^3/yr)	0	0	0	0	0
Contaminated Space[e]	ft^2 (m^2)	< 500 (46)	No change	No change	No change	No change
Number of Workers	FTEs	68[f]	95	95	95	113

[a] Index was used as a point of reference for projecting data for alternatives (as discussed on page 3–3). Index is NOT a consistent time period across parameters or facilities. Each parameter is footnoted with the index used.
[b] These values are not stack emissions. They are projections from Gaussian plume dispersion modeling. Values are from the first 394-foot (120-meter) radius. Other isotopes (nitrogen-13 and oxygen-15) are not shown due to very short half-lives.
[c] Index data for Argon-41 is from 1995
[d] Index is 1990 to 1995 average.
[e] Index is Fiscal Year 1995. Data are increments or decrements to the existing conditions.
[f] Index is Fiscal Year 1994.

TABLE 3.6.1–9.—*Alternatives for Continued Operation of Sigma Complex*

ACTIVITY	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Research and Development on Materials Fabrication, Coating, Joining, and Processing	Maintain and enhance capability to fabricate items from metals, ceramics, salts, beryllium, enriched uranium, depleted uranium, and other uranium isotope mixtures including casting, forming, machining, polishing, coating, and joining.	Same as the No Action Alternative.	Same as the No Action Alternative.	Same as the No Action Alternative.
Characterization of Materials	Maintain and enhance research and development activities on properties of ceramics, oxides, silicides, composites, and high-temperature materials	Modest increase over No Action Alternative, characterize accelerator production of tritium components	Same as the No Action Alternative.	Same as the No Action Alternative.
	Analyze up to 24 tritium reservoirs/yr.	Analyze up to 36 tritium reservoirs/yr.	Same as the No Action Alternative.	Same as the No Action Alternative.
	Develop library of aged non-SNM materials from stockpiled weapons and develop techniques to test and predict changes. Store and characterize up to 250 samples including uranium.	Store and characterize up to 2,500 non-SNM component samples, including uranium.	Same as the No Action Alternative.	Same as Expanded Operations Alternative.

TABLE 3.6.1–9.—*Alternatives for Continued Operation of Sigma Complex*-Continued

ACTIVITY	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Fabrication of Metallic and Ceramic Items	Fabricate stainless steel and beryllium components for about 50 pits/yr.	Fabricate stainless steel and beryllium components for about 80 pits/yr.	Same as the No Action Alternative.	Same as the No Action Alternative.
	Fabricate 50 to 100 reservoirs for tritium/yr.	Fabricate up to 200 reservoirs for tritium/yr.	Same as the No Action Alternative.	Same as the No Action Alternative.
	Fabricate components for up to 50 secondaries (of depleted uranium, depleted uranium alloy, enriched uranium, lithium hydride, and lithium deuteride) /yr.	Same as No Action Alternative.	Same as the No Action Alternative.	Same as the No Action Alternative.
	Fabricate nonnuclear components for research and development: 30 major hydrotests and 20 to 40 joint test assemblies/yr.	Fabricate nonnuclear components for research and development: 100 major hydrotests and 50 joint test assemblies/yr.	Same as the No Action Alternative.	Same as the No Action Alternative.
	Fabricate beryllium targets.	Modest increase over the No Action Alternative.	Same as the No Action Alternative.	Same as the No Action Alternative.
	Fabricate targets and other components for accelerator production of tritium research.	Same as the No Action Alternative.	Same as the No Action Alternative.	Same as the No Action Alternative.
	Fabricate test storage containers for nuclear materials stabilization.	Same as the No Action Alternative.	Same as the No Action Alternative.	Same as the No Action Alternative.
	Fabricate nonnuclear (stainless steel and beryllium) components for up to 20 pit rebuilds/yr.	Same as the No Action Alternative.	Same as the No Action Alternative.	Same as the No Action Alternative.

Note: All alternatives include Sigma Building renovation and facility modifications for pit support and beryllium technology support, as discussed in chapter 2 (section 2.2.2.5).

TABLE 3.6.1–10.—*Parameter Differences Among Alternatives for Continued Operation of the Sigma Complex (TA–3)*

PARAMETER	UNITS	INDEX[a]	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Radioactive Air Emissions	Ci/yr					
Uranium-234		2.20×10^{-6} [b]	2.20×10^{-5}	6.6×10^{-5}	2.20×10^{-5}	2.20×10^{-5}
Uranium-238		6.10×10^{-5}	6.10×10^{-4}	1.8×10^{-3}	6.10×10^{-4}	6.10×10^{-4}
NPDES Discharge						
Total Discharges	MGY (MLY)	7.3 (27.6)	7.3 (27.6)	7.3 (27.6)	7.3 (27.6)	7.3 (27.6)
03A–022[c]	MGY (MLY)	4.4[e] (16.7)	4.4 (16.7)	4.4 (16.7)	4.4 (16.7)	4.4 (16.7)
03A–024[d]	MGY (MLY)	2.9[f] (11.0)	2.9 (11.0)	2.9 (11.0)	2.9 (11.0)	2.9 (11.0)
Chemical Waste	lb/yr (kg/yr)	6,170[g] (2,800)	12,100 (5,500)	22,050 (10,000)	12,100 (5,500)	12,100 (5,500)
Low-Level Radioactive Waste	ft^3/yr (m^3/yr)	7,770[h] (220)	14,830 (420)	33,890 (960)	14,830 (420)	14,830 (420)
Low-Level Radioactive Mixed Waste	ft^3/yr (m^3/yr)	35[i] (1)	71 (2)	141 (4)	71 (2)	71 (2)
TRU/Mixed TRU Waste	m^3/yr	0	0	0	0	0
Contaminated Space[j]	ft^2	Not estimated	No change	No change	No change	No change
Number of Workers	FTEs	142[k]	178	284	178	178

[a] Index was used as a point of reference for projecting data for alternatives (as discussed on page 3–3). Index is NOT a consistent time period across parameters or facilities. Each parameter is footnoted with the index used.
[b] Index data for uranium isotopes is from 1990 to 1994.
[c] Outfall 03A–022 consists of one process source and some storm water drain sources.
[d] Outfall 03A–024 consists of process source only.
[e] Index is representative data provided by facility operations based on approximate water usage. No specific dates available.
[f] Index is representative data provided by Engineering Department based on frequency of blowdown. No specific dates available.
[g] Index is 1993 to 1995.
[h] Index is 1994 to 1995.
[i] Index is 1991 to 1995.
[j] This facility is expected (based on process knowledge) to have little or no contaminated space from past operations, so no estimate of the index was made (assumed to be none). Data are increments or decrements from the index.
[k] Index is Fiscal Year 1995.
MGY = million gallons per year; MLY = million liters per year.

TABLE 3.6.1–11.—*Alternatives for Continued Operation of the Materials Science Laboratory (TA–3–1698)*

ACTIVITY	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Materials Processing	Maintain eight capabilities at current levels of operation: • Synthesis/processing • Wet chemistry • Thermomechanical processing • Microwave processing • Heavy equipment materials • Single crystal growth • Amorphous alloys • Powder processing	No change to seven capabilities. Expand materials synthesis/ processing to develop cold mock-up of weapons assembly and processing. Expand materials synthesis/ processing to develop environmental and waste technologies.	Maintain capabilities and personnel. Significant decrease in the number of experiments for the eight research capabilities. Expand materials synthesis/processing to develop environmental and waste technologies.	No change to six capabilities. Expand wet chemistry to develop remediation chemistry capability. Expand materials synthesis/ processing research for nonweapons applications. Expand materials synthesis/ processing to develop environmental and waste technologies.
Mechanical Behavior in Extreme Environment	Maintain three capabilities at current levels of operation: • Mechanical testing • Dynamic testing • Fabrication and assembly	No change to two capabilities. Expand dynamic testing to include research and development for the aging of weapons materials. Develop a new research capability (machining technology).	Maintain capabilities and personnel. Significant decrease in the number of experiments for the three research capabilities.	No change to two capabilities. Expand mechanical testing research for nonweapons applications.
Advanced Materials Development	Maintain four capabilities at current levels of operation: • New materials • Synthesis and characterization • Ceramics • Superconductors	Same as No Action Alternative.	Maintain capabilities and personnel. Significant decrease in the number of experiments for three research capabilities. Reduce research effort for high-temperature superconductors.	No change to three capabilities. Increase research effort for high-temperature superconductors.
Materials Characterization	Maintain six capabilities at current levels of operation: • Surface science chemistry • Corrosion characterization • Electron microscopy • X-ray • Optical metallography • Spectroscopy	No change to four capabilities. Expand corrosion characterization to develop surface modification technology. Expand electron microscopy to develop plasma source ion implantation.	Significant decrease in the number of experiments for surface science chemistry and corrosion characterization. Eliminate capabilities for electron microscopy, x-ray, optical metallography, and spectroscopy.	Expand research in all six areas. Perform research into environmental corrosives.

TABLE 3.6.1–12.—*Parameter Differences Among Alternatives for Continued Operation of the Material Science Laboratory (TA–3)*

PARAMETER	UNITS	INDEX[a]	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Radioactive Air Emissions	Ci/yr	negligible	negligible	negligible	negligible	negligible
NPDES Discharge Volume	MGY	no outfalls	no outfalls	no outfalls	no outfalls	no outfalls
Chemical Waste	lb\yr (kg/yr)	660[b] (300)	1,320 (600)	1,320 (600)	1,320 (600)	1,320 (600)
Low-Level Radioactive Waste	m^3/yr	negligible	0	0	0	0
Low-Level Radioactive Mixed Waste	m^3/yr	0	0	0	0	0
TRU/Mixed TRU Waste	m^3/yr	0	0	0	0	0
Contaminated Space[c]	ft^2	Not estimated	No change	No change	No change	No change
Number of Workers	FTEs	82[d]	82	82	82	82

[a] Index was used as a point of reference for projecting data for alternatives (as discussed on page 3–3). Index is NOT a consistent time period across parameters or facilities. Each parameter is footnoted with the index used.
[b] Index value is the average of 1994 and 1995 data.
[c] This facility is expected (based on process knowledge) to have little or no contaminated space from past operations, so no estimate of the index was made (assumed to be none). Data are increments or decrements from the index.
[d] Index is Fiscal Year 1995.

TABLE 3.6.1–13.—*Alternatives for Continued Operation of the Target Fabrication Facility (TA–35)*

ACTIVITY	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Precision Machining and Target Fabrication	Provide targets and specialized components for about 1,200 tests/yr. Expect 10% growth in these operations/yr for the next 10 yrs.	Operations at about twice No Action Alternative including 20% increase in high explosives pulsed-power and increase for 100 high-energy density physics /yr.	Operations reduced to about one-third of No Action Alternative levels.	Same as No Action Alternative.
Polymer Synthesis	Produce polymers for targets and specialized components for about 1,200 tests/yr. Expect 10% growth in these operations/yr for the next 10 yrs.	Operations supporting laser and physics tests increase to twice No Action Alternative level, with 10 to 20% growth in DoD and high explosives pulsed-power target operations. Increased operations to support 100 high-energy density physics tests/yr.	Laser and physics test operations reduced to about one-third of No Action Alternative levels.	Laser and physics test operations remain at No Action Alternative level. Other operations redirected to advanced materials research and manufacturing, waste treatment, energy technologies, and environmental restoration technology.
Chemical and Physical Vapor Deposition	Coat targets and specialized components for about 1,200 tests/yr. Expect 10% growth in these operations/yr for the next 10 yrs.	Operations supporting laser and physics tests increase to twice No Action Alternative level, with 10 to 20% growth in DoD and high explosives pulsed-power target operations. Increase operations to support 100 high-energy density physics tests/yr. Support for pit rebuild operations double over 10-yr period. Other operations have low increase over No Action Alterative levels.	Laser and physics test operations reduced to about one-third of No Action Alternative levels.	Laser and physics test operations remain at No Action Alternative level. Other operations redirected to advanced materials research and manufacturing, waste treatment, energy technologies, and environmental restoration technologies with potential for moderate increase in operations.

TABLE 3.6.1–14.—*Parameter Differences Among Alteratives for Continued Operation of the Target Fabrication Facility (TA–35)*

PARAMETER	UNITS	INDEX[a]	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Radiological Air Emissions	Ci/yr	negligible	negligible	negligible	negligible	negligible
NPDES Discharge 04A–127[b]	MGY (MLY)	2.0[c] (7.6)	0	0	0	0
Chemical Waste	lb/yr (kg/yr)	4,170[d] (1,890)	8,380 (3,800)	8,380 (3,800)	8,380 (3,800)	8,380 (3,800)
Low-Level Radioactive Waste	ft^3/yr (m^3/yr)	180[e] (5)	350 (10)	350 (10)	350 (10)	350 (10)
Low-Level Radioactive Mixed Waste	ft^3/yr (m^3/yr)	7[f] (0.2)	14 (0.4)	14 (0.4)	14 (0.4)	14 (0.4)
TRU/Mixed TRU Waste	m^3/yr	0	0	0	0	0
Contaminated Space[g]	ft^2	Not estimated	No change	No change	No change	No change
Number of Workers	FTEs	71[h]	71	98	38	71

[a] Index was used as a point of reference for projecting data for alternatives (as discussed on page 3–3). Index is NOT a consistent time period across parameters or facilities. Each parameter is footnoted with the index used.
[b] Outfall 04A–127 consists of three process sources and four storm drains. Index is 1990 to 1995.
[c] Index is representative data; no specific index date available.
[d] Index is 1990 to 1995 average.
[e] Index is 1990 to 1993 average.
[f] Index is 1990 to 1991 average.
[g] This facility is expected (based on process knowledge) to have little or no contaminated space from past operations, so no estimate of the index was made (assumed to be none). Data are increments or decrements from the index.
[h] Index is representative data; no specific index date available.
MGY = million gallons per year; MLY = million liters per year.

TABLE 3.6.1–15.—*Alternatives for Continued Operation of the Machine Shops, TA–3*

ACTIVITY	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Fabrication of Specialty Components	Provide fabrication support for the dynamic experiments program and explosives research studies, support up to 30 hydrodynamic tests/yr, manufacture 20 to 40 joint test assemblies sets per yr and provide general laboratory fabrication support as requested.	Increase operations to support up to 100 hydrodynamic tests/yr., manufacture up to 50 joint test assemblies sets per yr, and provide general laboratory fabrication support as requested.	Same as No Action Alternative.	Same as No Action Alternative.
Fabrication Utilizing Unique Materials	Continue fabrication utilizing unique and unusual materials.	Up to three times No Action Alternative.	Same as No Action Alternative.	Same as No Action Alternative.
Dimensional Inspection of Fabricated Components	Provide appropriate dimensional inspection of above fabrication activities.	Provide appropriate dimensional inspection of above fabrication activities, and undertake additional types of measurements/inspections.	Same as No Action Alternative.	Same as No Action Alternative.

TABLE 3.6.1–16.—*Parameter Differences Among Alteratives for Continued Operation of the Machine Shops (TA–3)*

PARAMETER	UNITS	INDEX[a]	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Radioactive Air Emissions Uranium-238	Ci/yr	5.00×10^{-6} [b]	5.00×10^{-5}	1.50×10^{-4}	5.00×10^{-5}	5.00×10^{-5}
NPDES Discharge	MGY	No outfalls	No outfalls	No outfalls	No outfalls	No outfalls
Chemical Waste	lb/yr (kg/yr)	52,300[c] (23,700)	313,000 (142,000)	1,045,000 (474,000)	313,000 (142,000)	313,000 (142,000)
Low-Level Radioactive Waste	ft^3/yr (m^3/yr)	710[c] (20)	9,880 (280)	21,390 (606)	9,880 (280)	9,880 (280)
Low-Level Radioactive Mixed Waste	ft^3/yr (m^3/yr)	120[c] (3.3)	0	0	0	0
TRU/Mixed TRU Waste	ft^3/yr (m^3/yr)	0	0	0	0	0
Contaminated Space[d]	ft^2 (m^2)	Not estimated	+ 5,000 (460)	+ 10,000 (930)	+ 5,000 (460)	+ 5,000 (460)
Number of Workers	FTEs	60[e]	123	289	123	123

[a] Index was used as a point of reference for projecting data for alternatives (as discussed on page 3–3). Index is NOT a consistent time period across parameters or facilities. Each parameter is footnoted with the index used.
[b] Index data for uranium-238 is from 1993.
[c] Index is 1993 to 1995 average. Nonnuclear workload will increase substantially from the index.
[d] This facility is expected (based on process knowledge) to have little or no contaminated space from past operations, so no estimate of the index was made (assumed to be none). Data are increments or decrements from the index.
[e] Index is Fiscal Year 1996 as adjusted by the facility subject matter expert.

TABLE 3.6.1–17.—*Alternatives for the Continued Operation of the High Explosives Processing Facilities (TA–8, TA–9, TA–11, TA–16, TA–22, TA–29, and TA–37)*[a]

ACTIVITY	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
High Explosives Synthesis and Production	Continue low-level synthesis research and development, produce new materials and formulate explosives as needed. Increase process development. Produce material and components for directed stockpile production.	50% increase in synthesis research and development and formulation of explosives. Increase production of materials for evaluation and process development.	Activities reduced to approximately 60% of No Action Alternative.	Same as Reduced Operations Alternative.
High Explosives and Plastics Development and Characterization	Evaluate stockpile returns. Increase efforts in development and characterization of new plastics and high explosives for stockpile improvement. Improve predictive capabilities. Research high explosives waste treatment methods.	40% increase in developing and characterizing substitute materials for stockpile application. More efforts in predictive models, process development, and high explosives waste treatment.	Overall level of effort reduced to less than 60% of No Action Alternative.	Same as Reduced Operations Alternative.
High Explosives and Plastics Fabrication	Continue traditional stockpile surveillance and process development. Supply parts to Pantex for surveillance, stockpile rebuilds, and joint test assemblies. Increase fabrication for hydrodynamic and environmental testing.	Fabrication support increased: surveillance rebuild, + 40%; stockpile rebuilds, + 100%; surety and above ground test, + 50%.	Reduced efforts in fabrication as compared to No Action Alternative; War reserve refurbishment and weapons research and development, approximately 60% of No Action Alternative. Stockpile surveillance and above ground tests reduced to approximately 75% of No Action Alternative.	Same as Reduced Operations Alternative.
Test Device Assembly	Increase test device assembly to support stockpile related hydrodynamic tests, joint test assemblies, environmental and safety tests, and somewhat increased research and development. Approximately 30 major assembles/yr.	Increase operation to support approximately 100 major assemblies/yr.	Same as No Action Alternative.	Same as No Action Alternative.

TABLE 3.6.1–17.—*Alternatives for the Continued Operation of the High Explosives Processing Facilities (TA–8, TA–9, TA–11, TA–16, TA–22, TA–29, and TA–37)*[a]-Continued

ACTIVITY	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Safety and Mechanical Testing	Increase safety and environmental test related to stockpile assurance. Improve predictive models, approximately 12 safety and mechanical tests/yr.	50% increase in safety and environmental tests to support stockpile needs. Approximately 15 safety and mechanical tests/yr.	Testing activities reduced to approximately 80% of No Action Alternative.	Same as Reduced Operations Alternative.
Research, Development, and Fabrication of High-Power Detonators	Increase efforts to support assigned SSM activities; manufacture up to 20 major product lines per year. Support DOE complex for packaging and transportation of electro-explosive devices.	Increase operations to support 40 major product lines per year.	Same as No Action Alternative.	Same as No Action Alternative.

[a] The total amount of explosives and mock explosives used across all activities is an indicator of overall activity levels for this key facility. These amounts under each alternative are:

- No Action: 46,750 pounds (21,200 kilograms) of explosives and 1,590 pounds (720 kilograms) of mock explosives.
- Expanded Operations: 82,700 pounds (37,500 kilograms) of explosives and 2,910 pounds (1,320 kilograms) of mock explosives.
- Reduced Operations: 19,400 pounds (8,800 kilograms) of explosives and 1,150 pounds (520 kilograms) of mock explosives.
- Greener: 19,400 pounds (8,800 kilograms) of explosives and 1,150 pounds (520 kilograms) of mock explosives.

TABLE 3.6.1–18.—*Parameter Differences Among Alternatives for Continued Operation of High Explosives Processing (TA–8, TA–9, TA–11, TA–16, TA–22, TA–28, and TA–37)*

PARAMETER	UNITS	INDEX[a]	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Radioactive Air Emissions (TA–11)						
Uranium-238	Ci/yr	1.53×10^{-7} [b]	3.98×10^{-7}	9.96×10^{-7}	2.32×10^{-7}	2.32×10^{-7}
Uranium-235	Ci/yr	2.90×10^{-9}	7.56×10^{-9}	1.89×10^{-8}	4.41×10^{-9}	4.41×10^{-9}
Uranium-234	Ci/yr	5.69×10^{-8}	1.49×10^{-7}	3.71×10^{-7}	8.67×10^{-8}	8.67×10^{-8}
NPDES Discharge						
Total Discharges	MGY (MLY)	34 (129)	12.4 (47.0)	12.4 (47.0)	12.3 (46.6)	12.3 (46.6)
02A–007[c]	MGY (MLY)	10.5[d] (40)	7.4 (28.0)	7.4 (28.0)	7.4 (28.0)	7.4 (28.0)
03A–130	MGY (MLY)	0.037[e] (0.14)	0.037 (0.14)	0.037 (0.14)	0.037 (0.14)	0.037 (0.14)
04A–070	MGY (MLY)	0.22[f] (0.83)	0.0	0.0	0.0	0.0
04A–083[c]	MGY (MLY)	0.20[g] (0.76)	0.0	0.0	0.0	0.0
04A–092[c]	MGY (MLY)	1.57[f] (5.94)	0.0	0.0	0.0	0.0
04A–115[c]	MGY (MLY)	0.53[g] (2.01)	0.0	0.0	0.0	0.0
04A–157	MGY (MLY)	7.31[g] (27.7)	0.0	0.0	0.0	0.0
05A–053[c]	MGY (MLY)	0.124[d] (0.47)	0.0	0.0	0.0	0.0
05A–054	MGY (MLY)	3.57[d] (13.5)	3.6 (13.6)	3.6 (13.6)	3.6 (13.6)	3.6 (13.6)
05A–055	MGY (MLY)	0.036[d] (0.14)	0.13 (0.49)	0.13 (0.65)	0.10 (0.38)	0.10 (0.38)
05A–056	MGY (MLY)	2.53[d] (9.58)	0.0	0.0	0.0	0.0
05A–066[c]	MGY (MLY)	4.36[d] (16.5)	0.74 (2.80)	0.74 (2.80)	0.74 (2.80)	0.74 (2.80)
05A–067[c]	MGY (MLY)	0.33[d] (1.25)	0.33 (1.25)	0.33 (1.25)	0.33 (1.25)	0.33 (1.25)
05A–068[c]	MGY (MLY)	1.16[d] (4.39)	0.06 (0.23)	0.06 (0.23)	0.06 (0.23)	0.06 (0.23)
05A–069	MGY (MLY)	0.007[d] (0.03)	0.01 (0.04)	0.01 (0.04)	0.01 (0.04)	0.01 (0.04)
05A–071	MGY (MLY)	0.036[d] (0.14)	0.04 (0.15)	0.04 (0.15)	0.04 (0.15)	0.04 (0.15)
05A–072[c]	MGY (MLY)	0.0219[f] (0.08)	0.0	0.0	0.0	0.0
05A–096	MGY (MLY)	0.007[d] (0.03)	0.01 (0.04)	0.01 (0.04)	0.01 (0.04)	0.01 (0.04)
05A–097	MGY (MLY)	0.007[d] (0.03)	0.01 (0.04)	0.01 (0.04)	0.01 (0.04)	0.01 (0.04)
06A–073	MGY (MLY)	0.084[f] (0.32)	0.0	0.0	0.0	0.0
06A–074	MGY (MLY)	0.25[g] (0.95)	0.0	0.0	0.0	0.0
06A–075	MGY (MLY)	1.0[f] (3.79)	0.0	0.0	0.0	0.0
Chemical Waste	lb/yr (kg/yr)	20,300[h] (9,200)	24,300 (11,000)	28,700 (13,000)	15,400 (7,000)	15,400 (7,000)
Low-Level Radioactive Waste	ft^3/yr (m^3/yr)	210[i] (6)	390 (11)	560 (16)	280 (8)	280 (8)

TABLE 3.6.1–18.—*Parameter Differences Among Alternatives for Continued Operation of High Explosives Processing (TA–8, TA–9, TA–11, TA–16, TA–22, TA–28, and TA–37)*-Continued

PARAMETER	UNITS	INDEX[a]	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Low-Level Radioactive Mixed Waste	ft^3/yr (m^3/yr)	7[j] (0.2)	7 (0.2)	7 (0.2)	7 (0.2)	7 (0.2)
TRU/Mixed TRU Waste	ft^3/yr (m^3/yr)	0	0	0	0	0
Contaminated Space[k]	ft^2 (m^2)	Not estimated	No change	No change	No change	No change
Number of Workers	FTEs	148[l]	242	335	170	170

[a] Index was used as a point of reference for projecting data for alternatives (as discussed on page 3–3). Index is NOT a consistent time period across parameters or facilities. Each parameter is footnoted with the index used.
[b] Index is Fiscal Year 1995.
[c] Footnoted outfalls contain both process sources and storm water sources; otherwise, outfalls contain only process sources.
[d] Index is 1990 to 1995.
[e] Index is representative data; no specific index date available.
[f] Index data from ESH–18 measurements for NPDES permit application and from estimates based on facility operations. No specific dates available.
[g] Index estimated by facility operations based on approximate water usage. No specific index date available.
[h] Index is 1990 to 1995 average.
[i] Index is 1993 to 1995 average.
[j] Index is 1994 to 1995 average.
[k] This facility is expected (based on process knowledge) to have little or no contaminated space from past operations, so no estimate of the index was made (assumed to be none). Data are increments or decrements from the index.
[l] Provided as representative data by the facility subject matter expert. Index date not available.
MGY = million gallons per year; MLY = million liters per year.

TABLE 3.6.1–19.—*Alternatives for the Continued Operation of High Explosives Testing: TA–14 (Q-Site), TA–15 (R-Site), TA–36 (Kappa-Site), TA–39 (Ancho Canyon Site), and TA–40 (DF-Site)*

ACTIVITY	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Hydrodynamic Tests	Conduct up to 30 hydrodynamic tests/yr. Develop containment technology. Conduct baseline and code development tests of weapons configuration. Depleted uranium use of 2,900 lb/yr (over all activities).	Increase number of hydrodynamic tests to up to 100/yr. Depleted uranium use of about 6,900 lb/yr (over all activities).	Same as No Action Alternative.	Same as No Action Alternative.
Dynamic Experiments	Conduct dynamic experiments to study properties and enhance understanding of the basic physics of state and motion for materials used in nuclear weapons including some experiments with SNM.	Increase number of dynamic experiments by about 50%.	Same as No Action Alternative.	Same as No Action Alternative.
Explosives Research and Testing	Conduct high explosives tests to characterize explosive materials.	Up to twice No Action Alternative.	Same as No Action Alternative.	Same as No Action Alternative.
Munitions Experiments	Continued support of DoD in conventional munitions. Conduct experiments with projectiles and study other effects on munitions.	Same as No Action Alternative.	Same as No Action Alternative.	Same as No Action Alternative.
High Explosives Pulsed-Power (HEPP) Experiments	Conduct HEPP experiments and development tests.	Up to twice the number of HEPP experiments and development tests.	Same as No Action Alternative.	Same as No Action Alternative.
Calibration, Development, and Maintenance Testing	Conduct tests to provide calibration data, instrumentation development, and maintenance of image processing capability, etc.	Up to twice the number of tests.	Same as No Action Alternative.	Same as No Action Alternative.
Other Explosives Testing	Develop advanced high explosives or weapons evaluation techniques.	Increase the number of explosives studies by 50%.	Same as No Action Alternative.	Same as No Action Alternative.

Note: All alternatives include completion of construction for the DARHT Facility and its operation, as discussed in chapter 2 (section 2.2.2.10).

TABLE 3.6.1–20.—*Parameter Differences Among Alternatives for Continued Operation of High Explosives Testing, TA–14 (Q-Site) TA–15 (R-Site) TA–36 (Kappa Site), and TA–40 (DF-Site)*

PARAMETER	UNITS	INDEX[a]	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Radioactive Air Emissions[b]						
Depleted Uranium	Ci/yr	Not Available	5.0×10^{-2}	1.5×10^{-1}	5.0×10^{-2}	5.0×10^{-2}
Chemical Usage[c]						
TA–14						
Depleted Uranium	lb/yr (kg/yr)	6.6 (3)	22 (10)	66 (30)	22 (10)	22 (10)
Lead	lb/yr (kg/yr)	22 (10)	22 (10)	66 (30)	22 (10)	22 (10)
TA–15[d]						
Depleted Uranium	lb/yr (kg/yr)	730 (330)	1,980 (900)	5,950[e] (2,700)	1,980 (900)	1,980 (900)
Lead	lb/yr (kg/yr)	44 (20)	110 (50)	330 (150)	110 (50)	110 (50)
Beryllium	lb/yr (kg/yr)	22 (< 10)	22 (10)	66 (30)	22 (10)	22 (10)
Aluminum	lb/yr (kg/yr)	150 (70)	330 (150)	990 (450)	330 (150)	330 (150)
Copper	lb/yr (kg/yr)	44 (20)	220 (100)	660 (300)	220 (100)	220 (100)
Tantalum	lb/yr (kg/yr)	22 (< 10)	220 (100)	660 (300)	220 (100)	220 (100)
Tungsten	lb/yr (kg/yr)	22 (10)	220 (100)	660 (300)	220 (100)	220 (100)
TA–36						
Depleted Uranium	lb/yr (kg/yr)	330 (150)	880 (400)	2,650 (1,200)	880 (400)	880 (400)
Lead	lb/yr (kg/yr)	22 (< 10)	22 (10)	66 (30)	22 (10)	22 (10)
Beryllium	lb/yr (kg/yr)	0	22 (10)	66 (30)	22 (10)	22 (10)
Copper	lb/yr (kg/yr)	22 (10)	22 (10)	66 (30)	22 (10)	22 (10)
TA–39						
Lead	lb/yr (kg/yr)	0	22 (10)	66 (30)	22 (10)	22 (10)
Beryllium	lb/yr (kg/yr)	0	22 (10)	66 (30)	22 (10)	22 (10)
Aluminum[n]	lb/yr (kg/yr)	1,410 (640)	33,100 (15,000)	99,200 (45,000)	33,100 (15,000)	33,100 (15,000)
Copper[n]	lb/yr (kg/yr)	2,510 (1,140)	33,100 (15,000)	99,200 (45,000)	33,100 (15,000)	33,100 (15,000)
TA–40						
Copper	lb/yr (kg/yr)	44 (20)	220 (100)	660 (300)	220 (100)	220 (100)

TABLE 3.6.1–20.—*Parameter Differences Among Alternatives for Continued Operation of High Explosives Testing, TA–14 (Q-Site) TA–15 (R-Site) TA–36 (Kappa Site), and TA–40 (DF-Site)*-Continued

PARAMETER	UNITS	INDEX[a]	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
NPDES Discharge						
Total Discharges	MGY (MLY)	3.95 (15.0)	3.6 (13.6)	3.6 (13.6)	3.6 (13.6)	3.6 (13.6)
03A–028	MGY (MLY)	2.2[g] (8.33)	2.2 (8.33)	2.2 (8.33)	2.2 (8.33)	2.2 (8.33)
03A–185	MGY (MLY)	0.73[h] (2.76)	0.73 (2.76)	0.73 (2.76)	0.73 (2.76)	0.73 (2.76)
04A–101[f]	MGY (MLY)	< 0.05[i] (0.19)	0	0	0	0
04A–139	MGY (MLY)	None	None	None	None	None
04A–141	MGY (MLY)	0.031[h] (0.12)	0.0	0.0	0.0	0.0
04A–143	MGY (MLY)	0.018[h] (0.07)	0.018 (0.07)	0.018 (0.07)	0.018 (0.07)	0.018 (0.07)
04A–156	MGY (MLY)	0.091[h] (0.34)	0.0	0.0	0.0	0.0
06A–079	MGY (MLY)	0.54 (2.04)	0.54 (2.04)	0.54 (2.04)	0.54 (2.04)	0.54 (2.04)
06A–080	MGY (MLY)	0.027[h] (0.10)	0.03 (0.11)	0.03 (0.11)	0.03 (0.11)	0.03 (0.11)
06A–081	MGY (MLY)	0.027[h] (0.10)	0.03 (0.11)	0.03 (0.11)	0.03 (0.11)	0.03 (0.11)
06A–082	MGY (MLY)	0.027[h] (0.10)	0.0	0.0	0.0	0.0
06A–099[f]	MGY (MLY)	0.027[h] (0.10)	0.0	0.0	0.0	0.0
06A–100	MGY (MLY)	0.037[h] (0.14)	0.04 (0.15)	0.04 (0.15)	0.04 (0.15)	0.04 (0.15)
06A–123	MGY (MLY)	0.13[g] (0.49)	0.0	0.0	0.0	0.0
Chemical Waste	lb/yr (kg/yr)	52,700[j] (23,900)	55,600 (25,200)	77,800 (35,300)	55,600 (25,200)	55,600 (25,200)
Low-Level Radioactive Waste	ft^3/yr (m^3/yr)	2,800[j] (80)	10,600 (300)	33,200 (940)	10,600 (300)	10,600 (300)
Low-Level Radioactive Mixed Waste	ft^3/yr (m^3/yr)	3.5[j] (0.1)	10.6 (0.3)	31.8 (0.9)	10.6 (0.3)	10.6 (0.3)
TRU/Mixed TRU Waste[k]	ft^3/yr (m^3/yr)	0	7.1 (0.2)	7.1 (0.2)	7.1 (0.2)	7.1 (0.2)
Contaminated Space[l]	ft^2 (m^2)	Not estimated	No change	No change	No change	No change
Number of Workers	FTEs	341[m]	411	619	411	411

TABLE 3.6.1–20.—*Parameter Differences Among Alternatives for Continued Operation of High Explosives Testing, TA–14 (Q-Site) TA–15 (R-Site) TA–36 (Kappa Site), and TA–40 (DF-Site)*-Continued

[a] Index was used as a point of reference for projecting data for alternatives (as discussed on page 3–3). Index is NOT a consistent time period across parameters or facilities. Each parameter is footnoted with the index used.
[b] The isotopic composition of depleted uranium is approximately 99.7% uranium-238, approximately 0.3% uranium-235, and approximately 0.002% uranium-234. Because there are no historic measurements of emissions from these sites, projections are based on estimated release fractions of the materials used in tests.
[c] Index from 1990 and 1995 chemical inventory data (LANL 1990 and LANL 1995b).
[d] Usage for TA–15 includes operations at DARHT and other TA–15 firing sites. The usage at DARHT for the No Action Alternative is the same as analyzed in the DARHT EIS (DOE 1995c). Conservatively, no credit was taken for the phased containment to be implemented at DARHT because the full benefits of phased containment would not be realized until late in the period examined in this SWEIS.
[e] Usage listed for the Expanded Operations Alternative includes projections for expanded operations at DARHT as well as the other TA–15 firing sites, consistent with the Expanded Operations Alternative description (the highest foreseeable level of such activities that could be supported by the LANL infrastructure). No proposals are currently before DOE to exceed the material expenditures at DARHT that are evaluated in the DARHT EIS (DOE 1995c).
[f] Outfall contains both process sources and storm water sources.
[g] Index provided as representative data by facility operations personnel. No specific dates available.
[h] Index data is from ESH–18 measurements for NPDES permit application and from estimates based on facility operations. No specific dates available.
[i] Index is representative data provided by facility operations based on approximate water usage. No specific dates available.
[j] Index is 1990 to 1995 average.
[k] TRU waste (steel) will be generated as a result of DARHT's Phased Containment Option (see DARHT EIS [DOE 1995c]).
[l] Most of these activities occur outdoors and, in general, such activities do not have the potential to result in contamination within facilities; thus, no estimate of the index was made. Environmental contamination from such test activities is addressed in chapter 4 (sections 4.2, 4.3, and 4.5). Data are increments or decrements from the index.
[m] Data provided as representative data by the facility subject matter expert. No specific index date available.
[n] The quantities of copper and aluminum involved in these tests are used primarily in the construction of support structures. These structures are not expended in the explosive tests, and thus, do not contribute to air emissions.
MGY = million gallons per year; MLY = million liters per year.

TABLE 3.6.1–21.—*Alternatives for Continued Operation of the Los Alamos Neutron Science Center (TA–53)*

ACTIVITY	NO ACTION	EXPANDED OPERATIONS[c]	REDUCED OPERATIONS	GREENER[c]
Accelerator Beam Delivery, Maintenance, and Development	Deliver LANSCE linac beam to Areas A, B, C, WNR, Manuel Lujan Center, radiography sites, and new IPF for 8 months/yr (5,100 hrs). Positive ion current 1.00 milliampere and negative ion current of 200 microampere.	Deliver LANSCE linac beam to Areas A, B, C, WNR, Manuel Lujan Center, Dynamic Experiment Facility, and new IPF for 10 months/yr (6,400 hrs). Positive ion current 1.25 milliampere and negative ion current of 200 microampere.	Deliver LANSCE linac beam to Areas A, B, C, WNR, Manuel Lujan Center, radiography firing sites, and new IPF for 4 months/yr (2,600 hrs). Positive ion current 1.00 milliampere and negative ion current of 200 microampere.	Same as Expanded Operations Alternative.
	Reconfigure beam delivery and support equipment to support new facilities, upgrades, and experiments.[a]	Reconfigure beam delivery and support equipment to support new facilities, upgrades, and experiments.	Reconfigure beam delivery and support equipment to support new facilities, upgrades, and experiments.	
	Commission/operate/maintain LEDA for 6 yrs; operate up to approximately 6,600 hrs/yr.	Commission/operate/maintain LEDA for 10 to 15 yrs; operate up to approximately 6,600 hrs/yr.	Commission/operate/maintain 12-million electron volts LEDA for 2 yrs; operate up to approximately 1,000 hrs/yr.	
Experimental Area Support	Remote handling and radioactive waste disposal capability maintained.	Full-time remote handling and radioactive waste disposal capability required during Area A interior modifications, Area A East renovation.	Same as No Action Alternative.	Same as Expanded Operations Alternative.
	Support of experiments, facility upgrades, and modifications.	Support of experiments, facility upgrades, and modifications.		
	Increased power demand for LEDA radiofrequency operation.	Increased power demand for LANSCE linac and LEDA radiofrequency operation.	Same as No Action Alternative.	Same as Expanded Operations Alternative.

TABLE 3.6.1–21.—*Alternatives for Continued Operation of the Los Alamos Neutron Science Center (TA–53)*-Continued

ACTIVITY	NO ACTION	EXPANDED OPERATIONS[c]	REDUCED OPERATIONS	GREENER[c]
Neutron Research and Technology[b]	Conduct 500 to 1,000 experiments/yr using Manuel Lujan Center and WNR. Conduct accelerator production of tritium (APT) target neutronics experiment for 6 months. Support contained weapons-related experiments: • With small quantities of actinides, high explosives, and sources (up to approximately 40/yr) • With nonhazardous materials and small quantities of high explosives (up to approximately 100/yr) • With up to 10 lbs (4.5 kg) high explosives and/or depleted uranium (up to approximately 30/yr) • Shockwave experiments involving small amounts, up to (nominally) 0.18 oz (5 g) plutonium Provide support for static stockpile surveillance technology research and development.	Conduct 1,000 to 2,000 experiments/yr using Manuel Lujan Center, WNR, and LPSS. Establish LPSS in Area A (requires modification). Conduct APT target neutronics experiment for 6 months. Construct dynamic experiment laboratory adjacent to WNR. Support contained weapons-related experiments: • With small quantities of actinides, high explosives, and sources (up to approximately 80/yr) • With nonhazardous materials and small quantities of high explosives (up to approximately 200/yr) • With up to 10 lbs (4.5 kg) high explosives and/or depleted uranium (up to approximately 60/yr) • Shockwave experiments involving small amounts, up to (nominally) 1.8 oz (50 g) plutonium Provide support for static stockpile surveillance technology research and development.	Conduct 100 to 500 experiments/yr using Manuel Lujan Center and WNR. Support weapons-related experiments: • With small quantities of actinides, high explosives, and sources (up to approximately 20/yr) • With nonhazardous materials and small quantities of high explosives (up to approximately 50/yr) • With up to 10 lbs (4.5 kg) high explosives and/or depleted uranium (up to approximately 15/yr)	Conduct 1,000 to 2,000 experiments/yr using Manuel Lujan Center, WNR, and LPSS. Support weapons-related experiments: • With small quantities of actinides, high explosives, and sources (up to approximately 40/yr) • With nonhazardous materials and small quantities of high explosives (up to approximately 100/yr) • With up to 10 lbs (4.5 kg) high explosives and/or depleted uranium (up to approximately 30/yr) • Shockwave experiments involving small amounts, up to (nominally) 0.18 oz (5 g) plutonium

TABLE 3.6.1–21.—*Alternatives for Continued Operation of the Los Alamos Neutron Science Center (TA–53)*-Continued

ACTIVITY	NO ACTION	EXPANDED OPERATIONS[c]	REDUCED OPERATIONS	GREENER[c]
Accelerator-Driven Transmutation Technology (ADTT)	Conduct lead target tests for 2 yrs at Area A beam stop. Establish 1-megawatt ADTT target/blanket experiment area in Area A. Conduct low-power experiments (< 1 megawatt) for 8 months/yr for 4 yrs.	Conduct lead target tests for 2 yrs at Area A beam stop. Implement LIFT (establish 1-megawatt, then 5-megawatt ADTT target/blanket experiment areas) adjacent to Area A. Conduct 5-megawatt experiments for 10 months/yr for 4 yrs (using about 6.6 lbs (3 kg) of actinides).	Conduct basic research using existing LANSCE facilities.	Same as Expanded Operations Alternative.
Subatomic Physics Research	Conduct 5 to 10 physics experiments/yr at Manuel Lujan Center and WNR. Continue neutrino experiment through Fiscal Year 1997. Conduct proton radiography experiments, including contained experiments with high explosives.	Conduct 5 to 10 physics experiments/yr at Manuel Lujan Center, WNR, and LPSS. Continue neutrino experiment through Fiscal Year 1997. Conduct proton radiography experiments, including contained experiments with high explosives.	Same as No Action Alternative.	Same as Expanded Operations Alternative.
Medical Isotope Production	Irradiate up to approximately 40 targets/yr for medical isotope production.	Irradiate up to approximately 50 targets/yr. Added production of exotic and neutron-rich/neutron-deficient isotopes (requires modification of an existing target area).	Irradiate up to approximately 20 targets/yr.	Same as Expanded Operations Alternative.
High-Power Microwaves and Advanced Accelerators	Conduct research and development in these areas, including microwave chemistry research for industrial and environmental applications.	Same as No Action Alternative.	Research reduced to about 50 percent of the No Action Alternative levels. No research in microwave chemistry for industrial and environmental applications.	Same as No Action Alternative.

TABLE 3.6.1–21.—*Alternatives for Continued Operation of the Los Alamos Neutron Science Center (TA–53)*-Continued

[a] **Note:** All alternatives include the completion of proton and neutron radiography facilities, the LEDA, the IPF relocation, and the SPSS enhancement, as discussed in chapter 2 (section 2.2.2.11).

[b] Numbers of neutron experiments represent plausible levels of activity for each alternative. Bounding conditions for the consequences of operations are primarily determined by: (a) length and power of beam operation and (b) maintenance and construction activities.

[c] The Expanded Operations and Greener Alternatives at TA–53 include the facility construction or modification activities and the operations associated with the LPSS, the 5-megawatt target/blanket experimental area (also referred to as LIFT), the DEL, and the Exotic Isotope Production Facility (in addition to TA–53 activities previously reviewed under NEPA). The parameters presented in Table 3.6.1–22, and the impacts presented in section 3.6 (and in chapter 5, sections 5.3 and 5.5) include the construction and the operation impacts associated with these projects. There are no meaningful siting and construction alternatives for these projects because they are dependent on the delivery of an accelerator beam that is not provided at other LANL facilities. (Construction of a new accelerator solely to provide for these activities is not considered reasonable.)

H^+ = proton (positively charged ion), H^- = negatively charged hydrogen ion

TABLE 3.6.1–22.—*Parameter Differences Among Alternatives for Continued Operation of the Los Alamos Neutron Science Center (TA–53)*

PARAMETER	UNITS	INDEX[a]	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Radioactive Air Emissions[b]						
Argon-41 (10-yr average)	Ci/yr	2.4×10^{2}	4.81×10^{2}	7.68×10^{2}	2.46×10^{2}	7.68×10^{2}
1996 to 1997 average	Ci/yr		1.13×10^{3}	1.38×10^{3}	5.90×10^{2}	1.38×10^{3}
1998 to 1999 average	Ci/yr		6.01×10^{1}	7.44×10^{1}	3.12×10^{1}	7.44×10^{1}
2000 to 2001 average	Ci/yr		4.05×10^{2}	5.05×10^{2}	2.03×10^{2}	5.05×10^{2}
2002 to 2005 average	Ci/yr		4.05×10^{2}	9.37×10^{2}	2.03×10^{2}	9.37×10^{2}
Carbon-10 (10-yr average)	Ci/yr	2.08×10^{3}	1.35×10^{2}	1.53×10^{2}	1.05×10^{2}	1.53×10^{2}
1996 to 1997 average	Ci/yr		6.69×10^{2}	7.55×10^{2}	5.20×10^{2}	7.55×10^{2}
1998 to 2005 average	Ci/yr		2.12×10^{0}	2.65×10^{0}	1.06×10^{-0}	2.65×10^{0}
Carbon-11 (10-yr average)	Ci/yr	1.13×10^{4}	7.56×10^{3}	1.08×10^{4}	4.16×10^{3}	1.08×10^{4}
1996 to 1997 average	Ci/yr		1.90×10^{4}	2.30×10^{4}	1.14×10^{4}	2.30×10^{4}
1998 to 1999 average	Ci/yr		2.37×10^{3}	2.96×10^{3}	1.19×10^{3}	2.96×10^{3}
2000 to 2001 average	Ci/yr		5.47×10^{3}	6.84×10^{3}	2.74×10^{3}	6.84×10^{3}
2002 to 2005 average	Ci/yr		5.47×10^{3}	1.07×10^{4}	2.74×10^{3}	1.07×10^{4}
Nitrogen-13 (10-yr average)	Ci/yr	7.18×10^{3}	1.34×10^{3}	1.59×10^{3}	8.67×10^{2}	1.59×10^{3}
1996 to 1997 average	Ci/yr		4.98×10^{3}	5.81×10^{3}	3.48×10^{3}	5.81×10^{3}
1998 to 2005 average	Ci/yr		4.28×10^{2}	5.35×10^{2}	2.14×10^{2}	5.35×10^{2}
Nitrogen-16 (10-yr average)	Ci/yr	1.08×10^{3}	1.80×10^{2}	2.10×10^{2}	1.19×10^{2}	2.10×10^{2}
1996 to 1997 average	Ci/yr		8.98×10^{2}	1.05×10^{3}	5.95×10^{2}	1.05×10^{3}
1998 to 2005 average	Ci/yr		2.85×10^{-2}	2.85×10^{-2}	2.85×10^{-2}	2.85×10^{-2}
Oxygen-14 (10-yr average)	Ci/yr	7.5×10^{2}	7.32×10^{1}	8.33×10^{1}	5.63×10^{1}	8.33×10^{1}
1996 to 1997 average	Ci/yr		3.45×10^{2}	3.90×10^{2}	2.71×10^{2}	3.90×10^{2}
1998 to 2005 average	Ci/yr		5.29×10^{0}	6.61×10^{0}	2.65×10^{-0}	6.61×10^{0}
Oxygen-15 (10-yr average)	Ci/yr	2.84×10^{4}	2.79×10^{3}	3.18×10^{3}	2.09×10^{3}	3.18×10^{3}
1996 to 1997 average	Ci/yr		1.20×10^{4}	1.35×10^{4}	9.55×10^{3}	1.35×10^{4}
1998 to 2005 average	Ci/yr		4.84×10^{2}	6.06×10^{2}	2.32×10^{2}	6.06×10^{2}

TABLE 3.6.1–22.—*Parameter Differences Among Alternatives for Continued Operation of the Los Alamos Neutron Science Center (TA–53)*-Continued

PARAMETER	UNITS	INDEX[a]	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
LEDA Projections						
Oxygen-19 (8-yr average)	Ci/yr	Not Operating	2.16×10^{-3}	2.16×10^{-3}	2.16×10^{-3} [c]	2.16×10^{-3}
Sulfur-37 (8-yr average)	Ci/yr	Not Operating	1.81×10^{-3}	1.81×10^{-3}	1.81×10^{-3}	1.81×10^{-3}
Chlorine-39 (8-yr average)	Ci/yr	Not Operating	4.70×10^{-4}	4.70×10^{-4}	4.70×10^{-4}	4.70×10^{-4}
Chlorine-40 (8-yr average)	Ci/yr	Not Operating	2.19×10^{-3}	2.19×10^{-3}	2.19×10^{-3}	2.19×10^{-3}
Krypton-83m (8-yr average)	Ci/yr	Not Operating	2.21×10^{-3}	2.21×10^{-3}	2.21×10^{-3}	2.21×10^{-3}
Others (8-yr average)	Ci/yr	Not Operating	1.11×10^{-3}	1.11×10^{-3}	1.11×10^{-3}	1.11×10^{-3}
NPDES Discharge						
Total Discharges[d,e]	MGY (MLY)	16.8 (63.6)	67.7[f] (256)	81.8[f] (310)	26.2[f] (99.2)	81.8[f] (310)
03A–047	MGY (MLY)	2.64 (9.99)	4.7 (17.8)	7.1 (26.9)	2.3 (8.71)	7.1 (26.9)
03A–048	MGY (MLY)	8.56 (32.4)	15.6 (59.0)	23.4 (88.6)	7.7 (29.1)	23.4 (88.6)
03A–049	MGY (MLY)	4.15 (15.7)	7.5 (28.4)	11.3 (42.8)	3.7 (14.0)	11.3 (42.8)
03A–113	MGY (MLY)	0.9 (3.41)	39.7 (150)	39.8 (151)	12.3 (46.6)	39.8 (151)
03A–125	MGY (MLY)	0.18 (0.68)	0.18 (0.68)	0.18 (0.68)	0.18 (0.68)	0.18 (0.68)
03A–145	MGY (MLY)	0.37 (1.40)	0.0	0.0	0.0	0.0
Chemical Waste	lb/yr (kg/yr)	36,600[g] (16,600)	36,600 (16,600)	36,600 (16,600)	36,600 (16,600)	36,600 (16,600)
Low-Level Radioactive Waste	ft^3/yr (m^3/yr)	3,530[h] (100)	5,510 (156)	38,300[i] (1,085)	5,510 (156)	38,300[i] (1,085)
Low-Level Radioactive Mixed Waste	ft^3/yr (m^3/yr)	35[j] (1)	35 (1)	35 (1)	35 (1)	35 (1)
TRU/Mixed TRU Waste	ft^3/yr (m^3/yr)	0	0	0	0	0
Electric Power	megawatts	29[k]	58	63	38	63
Electricity	gigawatt-hours	104[k]	372	437	163	437
Water	MGY (MLY)	78[l] (295)	218 (825)	265 (1,000)	108 (409)	265 (1,000)
Contaminated Space[m]	ft^3/ft^2 (m^3/m^2)	380,000 (10,750)	+19,000 (1,770)	+24,000 (2,230)	+19,000 (1,770)	+19,000 (1,770)
Number of Workers	FTEs	741[n]	856	856	731	856

TABLE 3.6.1–22.—*Parameter Differences Among Alternatives for Continued Operation of the Los Alamos Neutron Science Center (TA–53)*-Continued

[a] Index was used as a point of reference for projecting data for alternatives (as discussed on page 3–3). Index is NOT a consistent time period across parameters or facilities. Each parameter is footnoted with the index used.
[b] 8-year average (1990 to 1997) is used as the basis for projected emissions for isotopes associated with the LEDA project. 5-year average (1991 to 1995) is used for the index for all other air emissions.
[c] For the Reduced Operations Alternative, power would be reduced from 40-million electron volts to 12-million electron volts. This would result in somewhat lower emissions; however, the relation is not linear. Therefore, no difference was shown in the Reduced Operations Alternative to remain conservative.
[d] Index is 1990 to 1995.
[e] All outfalls consist of process sources only.
[f] Values given across the alternatives are peak values for the 10 years. For most years, total discharges will be less.
[g] Index is 1990 to 1995.
[h] Index is 1992 to 1995.
[i] LLW volumes increase significantly in the Expanded Operations Alternative and Greener Alternative due to the LPSS project, which requires the decontamination and renovation of Experimental Area A (Building 53–03M).
[j] Assumed index value of 1. LLMW moratorium in mid 1990's caused changes in operations such that no more than 35 ft^3 (1 m^3) is expected.
[k] The index is the 6-year period 1990 to 1995.
[l] The index is 3-year average 1993 to 1995.
[m] Data are increments or decrements to the index. Index is May 1996. The index value is in ft^3 (m^3) because existing contamination is in materials in target areas that are best described in terms of volumes. The projections by alternative are in ft^2 (m^2) to recognize new areas that would have/handle irradiated or contaminated materials.
[n] Index is Fiscal Year 1995.
MGY = million gallons per year; MLY = million liters per year.

TABLE 3.6.1–23.—*Alternatives for the Continued Operation of the Health Research Laboratory (TA–43)*

ACTIVITY	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Genomic Studies	Conduct research utilizing molecular and biochemical techniques to analyze the genes of animals, particularly humans. Develop strategies at current levels to analyze the nucleotide sequence of individual genes, especially those associated with genetic disorders, and to identify their map genes and/or genetic diseases to locations on individual chromosomes. Part of this work is to map each nucleotide, in sequence, of each gene in all 46 chromosomes of the human genome.	Activities increased 25% above No Action Alternative.	Activities reduced to 20% of No Action Alternative.	Same as Expanded Operations Alternative.
Cell Biology	Conduct research at current levels utilizing whole cells and cellular systems, both in-vivo and in-vitro, to investigate the effects of natural and catastrophic cellular events like response to aging, harmful chemical and physical agents, and cancer.	Activities increased 40% above No Action Alternative.	Activities reduced to 30% of No Action Alternative.	Same as Expanded Operations Alternative.[a]
Cytometry	Conduct research utilizing laser imaging systems to analyze the structures and functions of subcellular systems.	Activities increased 33% above No Action Alternative.	Activities reduced to 25% of No Action Alternative.	Same as Expanded Operations Alternative.[a]
DNA Damage and Repair	Research using isolated cells to investigate DNA repair mechanisms.	Activities increased 40% above No Action Alternative.	Activities reduced to 30% of No Action Alternative.	Same as Expanded Operations Alternative.[a]

TABLE 3.6.1–23.—*Alternatives for the Continued Operation of the Health Research Laboratory (TA–43)*-Continued

ACTIVITY	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Environmental Effects	Research identifies specific changes that occur in DNA and proteins in certain microorganisms after events in the environment.	Activities increased 25% above No Action Alternative.	Activities reduced to 40% of No Action Alternative.	Same as Expanded Operations Alternative.[a]
Structural Cell Biology	Conduct research utilizing chemical and crystallographic techniques to isolate and characterize the three-dimensional shapes and properties of DNA and protein molecules.	Activities increased 50% above No Action Alternative.	Activities reduced to 20% of No Action Alternative.	Same as Expanded Operations Alternative.
Neurobiology	Conduct research using magnetic fields produced in active areas of the brain to map human brain locations associated with certain sensory and cognitive functions. Instrumentation is sensitive magnetic detection devices.	Activities increased to three times the level of the No Action Alternative.	Same activities as No Action Alternative.	Activities increased to two times the level of the No Action Alternative.
In-Vivo Monitoring	Continue 1,500 whole-body scans/yr as a service, a part of the LANL personnel monitoring program, which supports operations with radioactive materials conducted elsewhere at LANL.	Activities increased to 3,000 scans/yr.	Activities decreased to 500 scans/yr.	Same activities as Expanded Operations Alternative.

[a] Activity level is the same as Expanded Operations Alternative but FTE level is only slightly increased above the No Action Alternative. This is possible through use of more automated analytical apparatus.

TABLE 3.6.1–24.—*Parameter Differences in Alternatives for Continued Operation of the Health Research Laboratory (TA–43)*

PARAMETER	UNITS	INDEX[a]	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Radioactive Air Emissions	Ci/yr	Negligible	Not estimated	Not estimated	Not estimated	Not estimated
NPDES Discharge 03A–040[b]	MGY (MLY)	2.7[c] (10.2)	2.5[d] (9.46)	2.5 (9.46)	2.5 (9.46)	2.5 (9.46)
Chemical Waste	lb/yr (kg/yr)	10,800[e] (4,900)	15,400 (7,000)	28,700 (13,000)	11,000 (5,000)	28,700 (13,000)
Biomedical Waste	lb/yr (kg/yr)	290[e] (130)	110[f] (50)	620[g] (280)	110[f] (50)	620[f] (280)
Low-Level Radioactive Waste	ft^3/yr (m^3/yr)	810[e] (23)	490 (14)	1,200 (34)	490 (14)	1,200 (34)
Low-Level Radioactive Mixed Waste	ft^3/yr (m^3/yr)	14[e] (0.4)	95 (2.7)	120 (3.4)	88 (2.5)	120 (3.4)
TRU/Mixed TRU Waste	ft^3/yr (m^3/yr)	0	0	0	0	0
Electric Power[j]	MW	0.445[i]	0.5	0.7	0.2	0.5
Water[j]	MGY (MLY)	10.5[j] (39.7)	12 (45.4)	15 (56.8)	4 (15.1)	12 (45.4)
Contaminated Space[k] Total Radiation Wing Irradiator Suite	 ft^2 (m^2) ft^2 (m^2) ft^2 (m^2)	 93,000 (8,640) 1,730 (160) 840 (80)	No change	No change	No change	No change
Number of Workers	FTEs	180[l]	190	250	70	200

[a] Index was used as a point of reference for projecting data for alternatives (as discussed on page 3–3). Index is NOT a consistent time period across parameters or facilities. Each parameter is footnoted with the index used.
[b] Outfall 03A–040 consists of one process outfall and nine storm drains. The process outfall is scheduled for elimination.
[c] Index is data from ESH–18 measurements for NPDES permit application and from estimates based on facility operations. No specific dates available.
[d] Storm water only. Estimated as the difference between total volume and process cooling water volume. An expected roof area increase of 10% is factored in as well.
[e] Index is 1994 to 1995 average.
[f] Waste comes from the animal colony. The animal colony was downsized substantially in the 1996 to 1997 period; waste in 1997 (calendar) was 165 lbs (75 kg). A future change in animal colony size is projected only for the Expanded Operations Alternative.
[g] Animal colony and the associated waste are projected to double.
[h] Facility-specific data are available for HRL, which is metered.
[i] The index is the average of 1994 (0.44 megawatts) and 1995 (0.45 megawatts) usage.
[j] The index is the average of 1993 (10 MGY [38 MLY]) and 1994 (11 MGY [42 MLY]) usage.
[k] Data are increments or decrements to the index. Index is May 1996.
[l] Index is Fiscal Year 1994, as adjusted by the facility subject matter expert.
MGY = million gallons per year; MLY = million liters per year.

TABLE 3.6.1–25.—*Alternatives for Continued Operation of the Radiochemistry Facility (TA–48)*

ACTIVITY	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Radionuclide Transport Studies	Actinide transport, sorption, and bacterial interaction studies. Development of models for evolution of groundwater. Assessment of performance or risk of release for radionuclide sources at proposed waste disposal sites. 45 to 80 studies/yr.	Increased level of operations, approximately twice No Action Alternative. 80 to 160 studies/yr.	Reduced level of operations, approximately half No Action Alternative. 18 to 36 studies/yr.	Same level of activities as Expanded Operations Alternative, but activities are in support of environmental remediation.
Environmental Remediation Support	Background contamination characterization pilot studies. Performance assessments, soil remediation research and development, and field support at current levels.	Increased level of operations, approximately twice No Action Alternative.	Same as No Action Alternative.	Same as Expanded Operations Alternative.
Ultra-Low-Level Measurements	Isotope separation and mass spectrometry at current levels.	Increased level of operations, more than twice No Action Alternative.	Level of operations slightly reduced from No Action Alternative.	Same as Expanded Operations Alternative.
Nuclear/ Radiochemistry	Radiochemical operations involving quantities of alpha-, beta-, and gamma-emitting radionuclides at current levels for nonweapons and weapons work.	Slightly increased level of operations.	Reduced level of operations, approximately half of No Action Alternative.	About same activity level as No Action Alternative, but weapons work reduced by half, and nonweapons work increased by 10%.
Isotope Production	Target preparation. High-level beta/ gamma chemistry and target processing to recover isotopes for medical and industrial application.	Increased level of operations, approximately twice No Action Alternative.	Reduced level of operations, approximately half of No Action Alternative.	Same as No Action Alternative.
Actinide/ Transuranic Chemistry	Radiochemical operations involving significant quantities of alpha-emitting radionuclides at current level.	Increased level of operations, approximately twice No Action Alternative.	Reduced level of operations, approximately half of No Action Alternative.	Same level of activity as No Action Alternative, but activities are in support of nonweapons programs.

TABLE 3.6.1–25.—*Alternatives for Continued Operation of the Radiochemistry Facility (TA–48)*-Continued

ACTIVITY	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Data Analysis	Re-examination of archive data and measurement of nuclear process parameters of interest to weapons radiochemists at current levels.	Increased level of operations, approximately twice No Action Alternative.	Slightly reduced level of operations from No Action Alternative.	Same as Reduced Operations Alternative.
Inorganic Chemistry	Synthesis, catalysis, actinide chemistry (all activities at current level): • Chemical synthesis of new organo-metallic complexes • Structural and reactivity analysis, organic product analysis, and reactivity and mechanistic studies • Synthesis of new ligands for radiopharmaceuticals Environmental technology development (all activities at current level): • Ligand design and synthesis for selective extraction of metals • Soil washing • Membrane separator development • Ultra-filtration	Increased level of operations by 50% from No Action Alternative.	Same No Action Alternative.	Same as Expanded Operations Alternative.
Structural Analysis	Synthesis and structural analysis of actinide complexes at current levels. X-ray diffraction analysis of powders and single crystals at current levels.	Increased level of operations, almost twice No Action Alternative.	Same as No Action Alternative.	Same as Expanded Operations Alternative.
Sample Counting	Measurement of the quantity of radioactivity in samples using alpha-, beta-, and gamma-ray counting systems at current levels.	Same as No Action Alternative.	Same as No Action Alternative.	Same as No Action Alternative.

TABLE 3.6.1–26.—*Parameter Differences Among Alternatives for Continued Operation of the Radiochemistry Site (TA–48)*

PARAMETER	UNITS	INDEX[a]	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Radioactive Air Emissions						
Mixed Fission Products	Ci/yr	2.95×10^{-5}	1.1×10^{-4}	1.4×10^{-4}	6.9×10^{-5}	1.3×10^{-4}
Plutonium-239	Ci/yr	5.15×10^{-6}	5.5×10^{-6}	1.1×10^{-5}	5.2×10^{-6}	1.1×10^{-5}
Uranium-235[4]	Ci/yr	3.97×10^{-7}	4.0×10^{-7}	4.4×10^{-7}	2.0×10^{-7}	4.0×10^{-7}
Mixed Activation Products	Ci/yr	2.81×10^{-4}	1.6×10^{-6}	3.1×10^{-6}	7.8×10^{-7}	1.6×10^{-6}
Arsenic-72	Ci/yr	1.11×10^{-2}	5.6×10^{-5}	1.1×10^{-4}	2.8×10^{-5}	5.6×10^{-5}
Arsenic-73	Ci/yr	1.90×10^{-2}	9.5×10^{-5}	1.9×10^{-4}	4.8×10^{-5}	9.5×10^{-5}
Arsenic-74	Ci/yr	3.75×10^{-3}	2.0×10^{-5}	4.0×10^{-5}	9.8×10^{-6}	2.0×10^{-5}
Beryllium-7	Ci/yr	1.94×10^{-5}	7.4×10^{-6}	1.5×10^{-5}	3.6×10^{-6}	7.4×10^{-6}
Bromine-77	Ci/yr	2.37×10^{-2}	4.3×10^{-4}	8.5×10^{-4}	2.2×10^{-4}	4.3×10^{-4}
Germanium-68	Ci/yr	1.70×10^{-3}	8.5×10^{-6}	1.7×10^{-5}	4.3×10^{-6}	8.5×10^{-6}
Gallium-68	Ci/yr	1.70×10^{-3}	8.5×10^{-6}	1.7×10^{-5}	4.3×10^{-6}	8.5×10^{-6}
Rubidium-86	Ci/yr	2.76×10^{-5}	1.4×10^{-7}	2.8×10^{-7}	6.9×10^{-8}	1.4×10^{-7}
Selenium-75	Ci/yr	2.45×10^{-2}	1.6×10^{-4}	3.4×10^{-4}	8.3×10^{-5}	1.6×10^{-4}
NPDES Discharge						
Total Discharges	MGY (MLY)	15.6 (59.0)	4.1 (15.5)	4.1 (15.5)	4.1 (15.5)	4.1 (15.5)
03A–045[d]	MGY (MLY)	1.1[f] (4.16)	0.87[g] (3.29)	0.87 (3.29)	0.87 (3.29)	0.87 (3.29)
04A–016[e]	MGY (MLY)	6.3[f] (23.8)	No outfall[h]	No outfall	No outfall	No outfall
04A–131[e]	MGY (MLY)	0.95[f] (3.60)	No outfall[h]	No outfall	No outfall	No outfall
04A–152[e]	MGY (MLY)	4.0[f] (15.1)	No outfall[h]	No outfall	No outfall	No outfall
04A–153[d]	MGY (MLY)	3.2[f] (12.1)	3.2[g] (12.1)	3.2 (12.1)	3.2 (12.1)	3.2 (12.1)
Chemical Waste	lb/yr (kg/yr)	4,400 (2,000[i])	4,400 (2,000)	7,300 (3,300)	3,500 (1,600)	6,400 (2,900)
Low-Level Radioactive Waste	ft^3/yr (m^3/yr)	5,300 (150[i])	6,000 (170)	9,500 (270)	4,200 (120)	8,500 (240)
Low-Level Radioactive Mixed Waste	ft^3/yr (m^3/yr)	71 (2.0[i])	71 (2.0)	130 (3.8)	46 (1.3)	120 (3.4)
TRU/Mixed TRU Waste[j]	ft^3/yr (m^3/yr)	0	0	0	0	0
Contaminated Space[k]	ft^2 (m^2)	39,300 (3,600)	No change	No change	No change	No change
Number of Workers	FTEs	141[l]	171	248	132	248

TABLE 3.6.1–26.—*Parameter Differences Among Alternatives for Continued Operation of the Radiochemistry Site (TA–48)*-Continued

[a] Index was used as a point of reference for projecting data for alternatives (as discussed on page 3–3). Index is NOT a consistent time period across parameters or facilities. Each parameter is footnoted with the index used.
[b] Index data is the higher of stack emissions for 1994 or 1995.
[c] Uranium-235 index value is for 1994.
[d] Outfall consists of one process source and several storm water sources (roof drains).
[e] Outfall consists of one process source only.
[f] Index values from ESH–18 measurements for NPDES permit application and from estimates based on facility operations. No specific dates available.
[g] Estimates across the alternatives for outfalls 03A–045 and 04A–153 represent storm water only.
[h] Outfalls 04A–016 and 04A–152 were eliminated in August 1997, and these outfalls do not exist in any of the alternatives.
[i] Index 1990 to 1995 average.
[j] TRU waste is returned to the generating facility.
[k] Data are increments or decrements to the index. Index is May 1996.
[l] Index is February 1997 value.
MGY = million gallons per year; MLY = million liters per year.

TABLE 3.6.1–27.—*Alternatives for Continued Operation of the Radioactive Liquid Waste Treatment Facility (TA–50)*

ACTIVITY	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Waste Characterization, Packaging, Labeling	Support, certify, and audit generator characterization programs. Maintain waste acceptance criteria for RLW treatment facilities.	Same as No Action Alternative.	Same as No Action Alternative.	Same as No Action Alternative.
Waste Transport, Receipt, and Acceptance	Collect RLW from generators and transport to TA–50.	Same as No Action Alternative.	Same as No Action Alternative.	Same as No Action Alternative.
Radioactive Liquid Waste Pretreatment	Pretreat 185,000 gal/yr (700,000 l/yr) of RLW at TA–21. Pretreat 7,900 gal/yr (30,000 l/yr) of RLW from TA–55 in Room 60. Solidify, characterize, and package 71 ft^3/yr (2 m^3/yr) of TRU waste sludge in Room 60.	Pretreat 238,000 gal/yr (900,000 l/yr) of RLW at TA–21. Pretreat 21,100 gal/yr (80,000 l/yr) of RLW from TA–55 in Room 60. Solidify, characterize, and package 106 ft^3/yr (3 m^3/yr) of TRU waste sludge in Room 60.	Pretreat 158,000 gal/yr (600,000 l/yr) of RLW at TA–21. Pretreat 5,300 gal/yr (20,000 l/yr) of RLW from TA–55 in Room 60. Solidify, characterize, and package 71 ft^3/yr (2 m^3/yr) of TRU waste sludge in Room 60.	Pretreat 185,000 gal/yr (700,000 l/yr) of RLW at TA–21. Pretreat 6,600 gal/yr (25,000 l/yr) of RLW from TA–55 in Room 60. Solidify, characterize, and package 71 ft^3/yr (2 m^3/yr) of TRU waste sludge in Room 60.
Radioactive Liquid Waste Treatment	Install ultrafiltration and reverse osmosis equipment in 1997. Install equipment for nitrate reduction in 1999. Treat 6.6 MGY (25 MLY) of RLW. Dewater, characterize, and package 247 ft^3/yr (7 m^3/yr) of LLW sludge. Solidify, characterize, and package 812 ft^3/yr (23 m^3/yr) of TRU waste sludge.	Same as No Action Alternative except: • Treat 9.2 MGY (35 MLY) of RLW. • Dewater, characterize, and package 353 ft^3/yr (10 m^3/yr) of LLW sludge. • Solidify, characterize, and package 1,130 ft^3/yr (32 m^3/yr) of TRU waste sludge.	Same as No Action Alternative except: • Treat 5.3 MGY (20 MLY) of RLW. • Solidify, characterize, and package 671 ft^3/yr (19 m^3/yr) of TRU waste sludge.	Same as No Action Alternative.

TABLE 3.6.1–27.—*Alternatives for Continued Operation of the Radioactive Liquid Waste Treatment Facility (TA–50)*-Continued

ACTIVITY	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Decontamination Operations	Decontaminate personnel respirators for reuse (approximately 500/month). Decontaminate air-proportional probes for reuse (approximately 200/month). Decontaminate vehicles and portable instruments for reuse (as required). Decontaminate precious metals for resale (acid bath). Decontaminate scrap metals for resale (sand blast). Decontaminate 6,700 ft^3 (190 m^3) of lead for reuse (grit blast).	Same as No Action Alternative except: • Decontaminate LANL personnel respirators for reuse (approximately 700/month). • Decontaminate air-proportional probes for reuse (approximately 300/month). • Decontaminate 7,100 ft^3 (200 m^3) of lead for reuse (grit blast).	Same as No Action Alternative except: • Decontaminate LANL personnel respirators for reuse (approximately 300/month).	Same as No Action Alternative.

Note: Under all alternatives, influent storage tank upgrade, installation of a new process for treatment of radioactive liquid waste (RLW), and installation of additional treatment steps for removal of nitrates are all completed, as discussed in chapter 2 (section 2.2.2.14).

TABLE 3.6.1–28.—*Parameter Differences Among Alternatives for Continued Operations of the Radioactive Liquid Waste Treatment Facility (TA–50)*

PARAMETER	UNITS	INDEX[a]	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Radioactive Air Emissions[b]	Ci/yr	Negligible	Negligible	Negligible	Negligible	Negligible
Radioactive Liquid Waste Influent[c]	MGY (MLY)	5.3 (20.0)	6.6 (25.0)	9.3 (35.0)	5.3 (20.0)	6.6 (35.0)
NPDES Discharge Process[c]	MGY (MLY)	5.5[d] (20.8)	6.6 (25.0)	9.3 (35.0)	5.3 (20.0)	6.6 (25.0)
Radioactive Liquid Waste[d,e]	gal/yr (l/yr)	1,100 (4,000)	2,500 (9,500)	2,600 (10,000)	2,500 (9,500)	2,500 (9,500)
Chemical Waste[f]	lb/yr (kg/yr)	4,900 (2,200)	4,900 (2,200)	4,900 (2,200)	4,900 (2,200)	4,900 (2,200)
Low-Level Radioactive Waste[f]	ft^3/yr (m^3/yr)	5,300 (150)	5,300 (150)	5,600 (160)	5,300 (150)	5,300 (150)
Low-Level Radioactive Mixed Waste[g]	ft^3/yr (m^3/yr)	1,300 (38)	0	0	0	0
TRU/Mixed TRU Waste[f]	ft^3/yr (m^3/yr)	110 (3)	740 (21)	1,060 (30)	740 (21)	740 (21)
Contaminated Space[h]	ft^2 (m^2)	37,000 (3,400)	No change	No change	No change	No change
Number of Workers	FTEs	90[8]	98	110	96	98

[a] Index was used as a point of reference for projecting data for alternatives (as discussed on page 3–3). Index is NOT a consistent time period across parameters or facilities. Each parameter is footnoted with the index used.
[b] Radiological air emissions from this facility are minimal and would not vary across the alternatives.
[c] Outfall consists of process sources only.
[d] Index is 1994.
[e] Secondary wastes are generated during the treatment of RLW and as a result of decontamination operations. Examples include decontamination acid bath solutions and rinse waters, HEPA filters, personnel protective clothing and equipment, and sludges from the pretreatment and main RLW treatment processes.
[f] RCRA-listed hazardous chemicals are not used in RLWTF, and secondary mixed wastes are therefore not generated.
[g] Data are increments or decrements to the index. Index is May 1996. The index is the footprint of the facility; even though the entire facility is not contaminated, no other method of estimating contaminated space was devised.
[h] Index is Fiscal Year 1995.
MGY = million gallons per year; MLY = million liters per year.

TABLE 3.6.1–29.—*Alternatives for Continued Operation of the Solid Radioactive and Chemical Waste Facilities (TA–54 and TA–50)*

ACTIVITY	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Waste Characterization, Packaging, and Labeling	Support, certify, and audit generator characterization programs. Maintain WAC for LANL waste management facilities. Characterize 26,800 ft^3 (760 m^3) of legacy LLMW. Characterize 318,000 ft^3 (9,010 m^3) of legacy TRU waste. Verify characterization data at the Radioactive Assay and Nondestructive Test Facility for unopened containers of LLW and TRU waste. Maintain WAC for off-site treatment, storage, and disposal facilities. Overpack and bulk waste as required. Perform coring and visual inspection of a percentage of TRU waste packages. Ventilate 16,700 drums of TRU waste retrieved during TWISP. Maintain current version of WIPP WAC and liaison with WIPP operations.	Same as No Action Alternative.	Same as No Action Alternative.	Same as No Action Alternative.
Compaction	Compact up to 614,000 ft^3 (17,400 m^3) of LLW.	Compact up to 897,000 ft^3 (25,400 m^3) of LLW.	Compact up to 590,000 ft^3 (16,700 m^3) of LLW.	Compact up to 706,000 ft^3 (20,000 m^3) of LLW.

TABLE 3.6.1–29.—*Alternatives for Continued Operation of the Solid Radioactive and Chemical Waste Facilities (TA–54 and TA–50)*-Continued

ACTIVITY	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Size Reduction	Size reduce 91,800 ft^3 (2,600 m^3) of TRU waste at WCRR Facility and the Drum Preparation Facility.	Size reduce 102,000 ft^3 (2,900 m^3) of TRU waste at WCRR Facility and the Drum Preparation Facility.	Same as No Action Alternative.	Same as No Action Alternative.
Waste Transport, Receipt, and Acceptance	Collect chemical and mixed wastes from LANL generators, and transport to TA–54. Begin shipments to WIPP in 1999. Over the next 10 years: • Ship 32,000 tons (29,000 metric tons) of chemical wastes and 127,000 ft^3 (3,590 m^3) of LLMW, for off-site land disposal restrictions (LDR) treatment and disposal. • Ship 1,437,000 ft^3 (40,700 m^3) of LLW for off-site disposal. • Ship 318,000 ft^3 (9,010 m^3) of legacy TRU waste to WIPP. • Ship 86,800 ft^3 (2,460 m^3) of operational and environmental restoration TRU waste to WIPP. • Ship 101,000 ft^3 (2,850 m^3) of LLMW (environmental restoration soils) for off-site solidification and disposal. Annually receive, on average, 177 ft^3 (5 m^3) of LLW and TRU waste from off-site locations in 5 to 10 shipments.	Same as No Action Alternative, except over next 10 years: • Ship 35,300 tons (32,000 metric tons) of chemical wastes and 128,000 ft^3 (3,640 m^3) of LLMW, for off-site LDR treatment and disposal. • Ship no LLW or environmental restoration soils for off-site disposal. • Ship 193,000 ft^3 (5,460 m^3) of operational and environmental restoration TRU waste to WIPP.	Same as No Action Alternative, except over next 10 years: • Ship 32,000 tons (29,000 metric tons) of chemical wastes and 126,000 ft^3 (3,570 m^3) of LLMW for off-site LDR treatment and disposal. • Ship 2,578,000 ft^3 (73,030 m^3) of LLW for off- site disposal. • Ship 67,100 ft^3 (1,900 m^3) of operational and environmental restoration TRU waste to WIPP.	Same as No Action Alternative, except over next 10 years: • Ship 32,000 tons (29,000 metric tons) of chemical wastes and 127,000 ft^3 (3,610 m^3) of LLMW, for off-site LDR treatment and disposal. • Ship 2,587,000 ft^3 (73,300 m^3) of LLW for off-site disposal. • Ship 88,000 ft^3 (2,490 m^3) of operational and environmental restoration TRU waste to WIPP.

TABLE 3.6.1–29.—*Alternatives for Continued Operation of the Solid Radioactive and Chemical Waste Facilities (TA–54 and TA–50)*-Continued

ACTIVITY	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Waste Storage	Stage chemical and mixed wastes prior to shipment for off-site treatment, storage, and disposal. Store legacy TRU waste and LLMW. Store LLW uranium chips until sufficient quantities have accumulated for stabilization.	Same as No Action Alternative.	Same as No Action Alternative.	Same as No Action Alternative.
Waste Retrieval	Begin retrieval operations in 1997. Retrieve 166,000 ft^3 (4,700 m^3) of TRU waste from Pads 1, 2, 4 by 2004.	Same as No Action Alternative.	Same as No Action Alternative.	Same as No Action Alternative.
Other Waste Processing	Demonstrate treatment (e.g., electrochemical) of LLMW liquids. Land farm oil-contaminated soils at Area J. Stabilize 14,500 ft^3 (410 m^3) of uranium chips. Provide special-case treatment for 23,700 ft^3 (670 m^3) of TRU waste.	Same as No Action Alternative except: Stabilize 30,700 ft^3 (870 m^3) of uranium chips. Provide special-case treatment for 36,400 ft^3 (1,030 m^3) of TRU waste. Solidify 101,000 ft^3 (2,850 m^3) of LLMW (environmental restoration soils) for disposal at Area G.	Same as No Action Alternative.	Same as No Action Alternative.

TABLE 3.6.1–29.—*Alternatives for Continued Operation of the Solid Radioactive and Chemical Waste Facilities (TA–54 and TA–50)*-Continued

ACTIVITY	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Disposal	Over next 10 years: Dispose 3,530 ft^3 (100 m^3) of LLW in shafts at Area G. Dispose 1,271,000 ft^3 (36,000 m^3) of LLW in disposal cells at Area G. Dispose 3,530 ft^3/yr (100 m^3/yr) of administratively controlled industrial solid wastes in pits at Area J. Dispose nonradioactive classified wastes in shafts at Area J.	Same as No Action Alternative, except over next 10 years: • Dispose 14,800 ft^3 (420 m^3) of LLW in shafts at Area G. • Dispose 4,060,000 ft^3 (115,000 m^3) of LLW in disposal cells at Area G. • Expand on-site LLW disposal operations beyond existing Area G footprint.	Same as No Action Alternative, except over next 10 years: • Dispose 98,800 ft^3 (2,800 m^3) of LLW in disposal cells at Area G.	Same as No Action Alternative, except over next 10 years: • Dispose 14,500 ft^3 (410 m^3) of LLW in shafts at Area G. • Dispose 424,000 ft^3 (12,000 m^3) of LLW in disposal cells at Area G.

Note: Under all alternatives, the TRU waste Inspectable Storage Project storage domes for TRU wastes would be constructed, as discussed in chapter 2 (section 2.2.2.15).

TABLE 3.6.1–30.—*Parameter Differences Among Alternatives for Continued Operation of the Solid Radioactive and Chemical Waste Facilities (TA–54 and TA–50)*

PARAMETER	UNITS	INDEX[a]	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Radioactive Air Emissions[b]						
Tritium	Ci/yr	2.10×10^{1} [c]	4.83×10^{1}	6.09×10^{1}	4.83×10^{1}	5.46×10^{1}
Americium-241	Ci/yr	6.60×10^{-7}	6.60×10^{-7}	6.60×10^{-7}	6.60×10^{-7}	6.60×10^{-7}
Plutonium-238	Ci/yr	4.80×10^{-6}	4.80×10^{-6}	4.80×10^{-6}	4.80×10^{-6}	4.80×10^{-6}
Plutonium-239	Ci/yr	6.80×10^{-7}	6.80×10^{-7}	6.80×10^{-7}	6.80×10^{-7}	6.80×10^{-7}
Uranium-234	Ci/yr	8.00×10^{-6}	8.00×10^{-6}	8.00×10^{-6}	8.00×10^{-6}	8.00×10^{-6}
Uranium-235	Ci/yr	4.10×10^{-7}	4.10×10^{-7}	4.10×10^{-7}	4.10×10^{-7}	4.10×10^{-7}
Uranium-238	Ci/yr	4.00×10^{-6}	4.00×10^{-6}	4.00×10^{-6}	4.00×10^{-6}	4.00×10^{-6}
NPDES Discharge	MGY	No outfalls	No outfalls	No outfalls	No outfalls	No outfalls
Chemical Waste[d]	lb/yr (kg/yr)	243,000[e] (110,000)	2,030 (920)	2,030 (920)	2,030 (920)	2,030 (920)
Radioactive Liquid Waste	gal/yr (l/yr)	2,100[e] (8,000)	2,600 (10,000)	2,600 (10,000)	2,600 (10,000)	2,600 (10,000)
Low-Level Radioactive Waste[d]	ft^3/yr (m^3/yr)	3,100[e] (88)	6,100 (174)	6,100 (174)	6,100 (174)	6,100 (174)
Low-Level Mixed Waste[d]	ft^3/yr (m^3/yr)	110[e] (3)	140 (4)	140 (4)	140 (4)	140 (4)
TRU/Mixed TRU Waste[d]	ft^3/yr (m^3/yr)	950[e] (27)	950 (27)	950 (27)	950 (27)	950 (27)
Contaminated Space[f]	ft^2 (m^2)	Not estimated	+ 11,500 (1,100)	+ 11,500 (1,100)	+ 11,500 (1,100)	+ 11,500 (1,100)
Number of Workers	FTEs	144[g]	195	225	192	198

[a] Index was used as a point of reference for projecting data for alternatives (as discussed on page 3–3). Index is NOT a consistent time period across parameters or facilities. Each parameter is footnoted with the index used.
[b] Values for tritium were determined from the emission estimates for the index and the differences in waste volumes by alternative.
[c] Index for the emissions is 1990 to 1994.
[d] Secondary wastes are generated during the treatment, storage, and disposal of chemical and radioactive wastes. Examples include repackaging wastes from the visual inspection of TRU waste, HEPA filters, personnel protective clothing and equipment, and process wastes from size reduction and compaction. The large difference between the index and projections for chemical waste generation are due to a change in operations. The generation of barium-contaminated sands, formerly treated at Area L and disposed at Area J, was ended in 1995.
[e] Index is 1990 to 1995.
[f] This facility is expected (based on process knowledge) to have little or no contaminated space from past operations, so no estimate of the index was made (assumed to be none.) Data are increments or decrements from the index. The contaminated space projections are for activities in TA–50 (RAMROD and WCRR) that were previously reviewed under NEPA.
[g] Index is Fiscal Year 1995.
MGY = million gallons per year.

TABLE 3.6.1–31.—*Parameters for LANL Activities Other Than Those at the Key Facilities*

PARAMETER	UNITS	ONGOING	INDEX YEAR
Radioactive Air Emissions[a]			
Tritium	Ci/y	9.1×10^{2}	1994
Plutonium	Ci/y	3.3×10^{-6}	1994
Uranium	Ci/y	1.8×10^{-4}	1994
NPDES Discharge	MGY (MLY)	142 (537)	1996
Chemical Waste	lb/yr (kg/yr)	1,435,000 (651,000)	1990 to 1994
Low-Level Radioactive Waste	ft^3/yr (m^3/yr)	18,400 (520)	1990 to 1994
Low-Level Mixed Radioactive Waste	ft^3/yr (m^3/yr)	1,060 (30)	1990 to 1994
TRU/Mixed TRU Waste	ft^3/yr (m^3/yr)	0	
Contaminated Space[b]	ft^2 (m^2)	222,930 (20,700)	
	ft^3 (m^3)	224,060 (6,300)	1996
	tons (metric tons)	350 (320)	
Number of Workers	FTEs	6579	1996

[a] Stack emissions from previously active facilities (TA–33, TA–21, and TA–41); these are not projected as continuing emissions in the future. Does not include nonpoint sources.
[b] As discussed further in chapter 4, section 4.9.4, contaminated space is estimated by square footage where feasible. However, ductwork in some facilities, rubble from cleanup actions, and activated materials from accelerator target areas are better estimated on the basis of cubic footage (or in the case of lead shielding, in tonnage).
MGY = million gallons per year; MLY = million liters per year.

TABLE 3.6.2–1.—*Comparison of Potential Consequences of Continued Operations of LANL: Normal Operations*

RESOURCE AREA	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
LAND RESOURCES				
Land Use	No changes projected, except where specific environmental restoration actions change use from waste disposal back to research and development or explosives land uses (none specifically known at this time).	Same as No Action Alternative.	Same as No Action Alternative.	Same as No Action Alternative.
Visual Resources	Temporary and minor changes due to equipment associated with construction and environmental restoration activities.	Same as No Action Alternative, plus effects of lighting for the transportation corridor constructed under this alternative.	Same as No Action Alternative.	Same as No Action Alternative.
Noise	Continued ambient noise at existing levels, temporary and minor noise associated with construction, and explosives noise and vibration at increased frequencies and at the same amplitudes as compared to recent experience.	Individual activities similar to those under No Action Alternative. Additional construction would result in additional temporary and minor noise. Noise and vibration associated with explosives testing is more frequent under this alternative, but the amplitude is the same as compared to No Action Alternative.	Same as No Action Alternative.	Same as No Action Alternative.
GEOLOGY AND SOILS				
Geology	LANL activities are not expected to change geology in the area, trigger seismic events, or substantively change slope stability.	Same as No Action Alternative.	Same as No Action Alternative.	Same as No Action Alternative.

TABLE 3.6.2–1.—*Comparison of Potential Consequences of Continued Operations of LANL: Normal Operations*-Continued

RESOURCE AREA	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Soils	Minimal deposition of contaminants to soils and continued removal of existing contaminants under the Environmental Restoration Project.	Same as No Action Alternative.	Same as No Action Alternative.	Same as No Action Alternative.
WATER RESOURCES				
Water Use	Effect of water use over the next 10 years (extracted from main aquifer) is an average drop in DOE well fields of up to 13 feet (4.0 meters).	Effect of water use over the next 10 years (extracted from main aquifer) is an average drop in DOE well fields of up to 15 feet (4.6 meters).	Effect of water use over the next 10 years (extracted from main aquifer) is an average drop in DOE well fields of up to 10 feet (3.1 meters).	Effect of water use over the next 10 years (extracted from main aquifer) is an average drop in DOE well fields of up to 14 feet (4.3 meters).
NPDES Outfall Volumes	261 MGY (988 MLY) discharged from outfalls (an increase of about 28 MGY (106 MLY) from recent discharges).	278 MGY (1,052 MLY) discharged from outfalls (an increase of about 45 MGY (170 MLY) from recent discharges).	218 MGY (825 MLY) discharged from outfalls (a decrease of about 15 MGY (57 MLY) from recent discharges).	275 MGY (1,041 MLY) discharged from outfalls (an increase of about 42 MGY (160 MLY) from recent discharges).
Effect of Outfall Flows on Groundwater Quantities	No substantial changes to groundwater quantities are expected, as compared to recent experience, due to outfall flows.	Same as No Action Alternative.	Same as No Action Alternative.	Same as No Action Alternative.
Surface Water Quality	Outfall water quality should be similar to or better than in recent experience, so surface water quality on the site is not expected to change substantially as compared to existing quality.	Same as No Action Alternative.	Same as No Action Alternative.	Same as No Action Alternative.
Surface Contaminant Transport	Continued outfall flows are not expected to result in substantial contaminant transport off the site.	Similar to No Action Alternative; the small increase in outfall flows (as compared to No Action) are not expected to result in substantial contaminant transport off site.	Same as No Action Alternative.	Same as Expanded Operations Alternative.

TABLE 3.6.2–1.—*Comparison of Potential Consequences of Continued Operations of LANL: Normal Operations*-Continued

RESOURCE AREA	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Groundwater Quality	Mechanisms for recharge to groundwater are highly uncertain; thus, the potential for LANL operations to contaminate groundwater is highly uncertain. It is possible that increased discharges could increase contaminant transport beneath Los Alamos Canyon and Sandia Canyon and off site due to increased recharge to intermediate perched groundwater. No other effects can be projected based on existing information.	Same as No Action Alternative.	Although NPDES outfall flows are lower than in the other alternatives, it is still possible that the flows under this alternative could transport contaminants beneath Los Alamos Canyon and Sandia Canyon and off site.	Same as No Action Alternative.
AIR QUALITY				
Criteria Pollutants	Criteria pollutant emissions are not expected to exceed ambient air quality standards and are not expected to approach levels that could affect human health.	Same as No Action Alternative. Construction activities associated with the expansion of Area G and the enhancement of pit manufacturing would be transitory and would not be expected to degrade air quality substantially.	Same as No Action Alternative.	Same as No Action Alternative.

TABLE 3.6.2–1.—*Comparison of Potential Consequences of Continued Operations of LANL: Normal Operations*-Continued

RESOURCE AREA	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Toxic Pollutants	Toxic air pollutants, including carcinogenic pollutants, are not expected to approach levels that could affect human health.	Firing site toxic emissions and the total of carcinogenic pollutant emissions exceeded screening values; but, more detailed analysis does not indicate that these emissions would have a significant effect on ecological resources or human health (see comments under those resource areas). Construction activities associated with the expansion of Area G and the enhancement of pit manufacturing would be transitory and would not be expected to degrade air quality substantially.	Same as No Action Alternative.	Same as No Action Alternative.
Radioactive Emissions Dose to the Public Maximally Exposed Individual (MEI)	3.1 millirem (mrem)/year to the LANL MEI (see human health effects below).	5.4 mrem/year to the LANL MEI (see human health effects below).	1.9 mrem/year to the LANL MEI (see human health effects below).	4.5 mrem/year to the LANL MEI (see human health effects below).
Radioactive Emissions Population Dose	About 14 person-rem/year to the population within 50 miles (80 kilometers) of LANL (see human health effects below).	About 33 person-rem/year to the population within 50 miles (80 kilometers) of LANL (see human health effects below).	About 11 person-rem/year to the population within 50 miles (80 kilometers) of LANL (see human health effects below).	About 14 person-rem/year to the population within 50 miles (80 kilometers) of LANL (see human health effects below).
ECOLOGICAL AND BIOLOGICAL RESOURCES				
Biological Resources, Ecological Processes, and Biodiversity	No significant adverse impacts projected for biological resources, ecological processes, or biodiversity, including threatened and endangered species.	Same as the No Action Alternative.	Same as No Action Alternative.	Same as No Action Alternative.

TABLE 3.6.2–1.—*Comparison of Potential Consequences of Continued Operations of LANL: Normal Operations*-Continued

RESOURCE AREA	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Habitat Reduction	No reduction in habitat projected.	Removal of about 7 acres (2.8 hectares) of habitat for small mammals and birds, plus fencing that could alter large mammal movement, are associated with the proposed dedicated road between TA–55 and TA–3. Gradual removal of up to approximately 41 acres (17 hectares) of pinyon-juniper woodland associated with the Area G expansion; corresponds to small wildlife habitat loss and disturbance.	Same as No Action Alternative.	Same as No Action Alternative.
Ecological Risk	No significant risk to biotic communities due to LANL legacy contamination or contamination due to ongoing operations.	Same as No Action Alternative.	Same as No Action Alternative.	Same as No Action Alternative.

TABLE 3.6.2–1.—*Comparison of Potential Consequences of Continued Operations of LANL: Normal Operations*-Continued

RESOURCE AREA	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
HUMAN HEALTH				
Public Health —Radiological (inhalation, ingestion, and external radiation pathways)[a]	Average total ingestion dose to: • Los Alamos County resident: 3.9 mrem/year of operation (2.0×10^{-6} excess LCFs/year of operation). • Non-Los Alamos County resident: 7.5 mrem/year of operation (3.8×10^{-6} excess LCFs/year of operation). • Nonresident recreational user: 0.2 mrem/year of operation (1.0×10^{-7} excess LCFs/year of operation). • Resident recreational user: 0.6 mrem/year of operation (2.8×10^{-7} excess LCFs/year of operation). Air pathway dose to: • LANL MEI: 3.11 mrem/year of operation (1.6×10^{-6} excess LCFs/year of operation). • Total population: 14 person-rem/year of operation (0.007 excess LCF/year of operation).	Average total ingestion doses are the same as under the No Action Alternative. Air pathway dose to: • LANL MEI: 5.44 mrem/year of operation (2.7×10^{-6} excess LCFs/ year of operation). • Total population: 33 person-rem/ year of operation (0.017 excess LCF/year of operation).	Average total ingestion doses are the same as under the No Action Alternative. Air pathway dose to: • LANL MEI: 1.88 mrem/year of operation (9.4×10^{-7} excess LCFs/year of operation). • Total population: 11 person-rem/year of operation (0.005 excess LCF/year of operation).	Average total ingestion doses are the same as under the No Action Alternative. Air pathway dose to: • LANL MEI: 4.52 mrem/year of operation (2.3×10^{-6}excess LCFs/year of operation). • Total population: 14 person-rem/year of operation (0.007 excess LCF/year of operation).
Public Health —Chemical	No significant effect to off-site residents or to the recreational user.	Same as No Action Alternative.	Same as No Action Alternative.	Same as No Action Alternative.
Special Pathways	No significant effect through special pathways (< 1×10^{-6} excess LCFs/year of operation).	Same as No Action Alternative.	Same as No Action Alternative.	Same as No Action Alternative.

TABLE 3.6.2–1.—*Comparison of Potential Consequences of Continued Operations of LANL: Normal Operations*-Continued

RESOURCE AREA	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Worker Health—Radiological[a]	• Collective worker dose: 446 person-rem/year of operation (0.18 excess LCF/year of operation). • Average (non-zero) worker dose: 0.14 rem/year of operation (0.00005 excess LCF/year of operation).	• Collective worker dose: 833 person-rem/year of operation (0.33 excess LCF/year of operation). • Average (non-zero) worker dose: 0.24 rem/year of operation (0.000096 excess LCF/year of operation).	• Collective worker dose: 170 person-rem/year of operation (0.07 excess LCF/year of operation). • Average (non-zero) worker dose: 0.08 rem/year of operation (0.00003 excess LCF/year of operation).	• Collective worker dose: 472 person-rem/year of operation (0.19 excess LCF/year of operation). • Average (non-zero) worker dose: 0.14 rem/year of operation (0.00005 excess LCF/year of operation).
Worker Health—Chemical	1 to 3 reportable chemical exposures per year (none expected to result in serious injury or in fatalities).	2 to 5 reportable chemical exposures per year (none expected to result in serious injury or in fatalities).	Same as No Action Alternative.	Same as No Action Alternative.
Worker Health—Physical Safety Hazards	About 445 reportable cases per year.	About 507 reportable cases per year.	About 417 reportable cases per year.	Same as No Action Alternative.
ENVIRONMENTAL JUSTICE				
Environmental Justice Impacts	No disproportionately high or adverse impacts to minority or low-income populations identified.	Same as No Action Alternative.	Same as No Action Alternative.	Same as No Action Alternative.
CULTURAL RESOURCES				
Prehistoric Resources	Negligible to minor potential for effects to some prehistoric resources due to shrapnel or vibrations from explosives testing. However, inspection of resources does not indicate that past operations have caused such effects. Other effects of ongoing operations are negligible or small compared to legacy contamination and natural effects.	Similar to the impacts under No Action, except that Expanded Operations would mean increased frequency of explosives testing (potentially accelerating any damage due to shrapnel and ground vibration). In addition, the expansion of Area G could affect 15 NRHP sites; it is anticipated that a determination of no adverse effect would be achieved based on a data recovery plan.	Same as No Action Alternative.	Same as No Action Alternative.

TABLE 3.6.2–1.—*Comparison of Potential Consequences of Continued Operations of LANL: Normal Operations*-Continued

RESOURCE AREA	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Historic Resources	Negligible potential for future operations to add contaminants that may limit preservation options. Other effects of ongoing operations are negligible or small compared to legacy contamination and natural effects.	Similar to the impacts under No Action, except that Expanded Operations would mean increased frequency of explosives testing (potentially accelerating damage due to shrapnel and ground vibration).	Same as No Action Alternative.	Same as No Action Alternative.
Traditional Cultural Properties	Unknown due to a lack of information on specific TCPs. Potential for effects to all types of TCPs due to changes in water quality and quantity, erosion, explosives testing shrapnel, noise and vibrations from explosives testing, and contamination from ongoing operations. Security at LANL can prevent access by traditional communities to some TCPs.	Highly uncertain due to a lack of information on specific TCPs. Similar to the impacts under No Action, except that Expanded Operations would mean increased frequency of explosives testing (potentially accelerating damage due to shrapnel, ground vibration, and noise). Additionally, TCPs could be affected by the expansion of Area G; coordination with the four Accord Pueblos would be pursued to identify and mitigate any potential adverse effects.	Same as No Action Alternative.	Same as No Action Alternative.
SOCIOECONOMICS, INFRASTRUCTURE, AND WASTE MANAGEMENT				
LANL Employment	9,977 full-time equivalents	11,351 full-time equivalents	9,347 full-time equivalents	9,968 full-time equivalents
Tri-County Employment	Increase of 691 full-time equivalents, as compared to the 1995 regional employment, about 85,720.	Increase of 2,186 full-time equivalents, as compared to 1995 regional employment.	Decrease of 33 full-time equivalents, as compared to 1995 regional employment.	Increase of 680 full-time equivalents, as compared to 1995 regional employment.
Tri-County Population	Increase of 1,337 people, as compared to the estimated 1996 Tri-County population of 165,938.	Increase of 4,230 people, as compared to the 1996 estimated population.	Decrease of 64 people, as compared to the 1996 estimated population.	Increase of 1,316 people, as compared to the 1996 estimated population.

TABLE 3.6.2–1.—*Comparison of Potential Consequences of Continued Operations of LANL: Normal Operations*-Continued

RESOURCE AREA	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Tri-County Personal Income	Increase of about $53 million, as compared to the 1994 estimate of $3.5 billion.	Increase of $172 million, as compared to the 1994 estimate.	Decrease of $6 million, as compared to the 1994 estimate.	Increase of $55 million, as compared to the 1994 estimate.
Maximum Annual Electrical Demand	717 gigawatt-hours	782 gigawatt-hours	508 gigawatt-hours	782 gigawatt-hours
Peak Electrical Demand	108 megawatts (exceeds supply during winter and summer months). May result in brownouts.	113 megawatts (exceeds supply during winter and summer months). May result in brownouts.	88 megawatts (exceeds supply during winter and within the existing supply throughout the rest of the year). May result in brownouts.	113 megawatts (exceeds supply during winter and summer months). May result in brownouts.
Maximum Annual Natural Gas Demand	1,840,000 decatherms (well within existing supply capacity).	Same as No Action Alternative.	Same as No Action Alternative.	Same as No Action Alternative.
Maximum Annual Water Demand	712 MGY (2,700 MLY) (DOE rights to water from main aquifer are adequate to meet this demand and other demands that draw from this right to water).	759 MGY (2,900 MLY) (DOE rights to water from main aquifer are adequate to meet this demand and other demands that draw from this right to water).	602 MGY (2,300 MLY) (DOE rights to water from main aquifer are adequate to meet this demand and other demands that draw from this right to water).	759 MGY (2,900 MLY) (DOE rights to water from main aquifer are adequate to meet this demand and other demands that draw from this right to water).
Annual Chemical Waste Generation	6,364,000 pounds (2,886,000 kilograms)	7,164,000 pounds (3,249,000 kilograms)	6,346,000 pounds (2,878,000 kilograms)	6,372,000 pounds (2,890,000 kilograms)
Annual LLW Generation (includes LLMW)	344,000 cubic feet (9,752 cubic meters)	454,000 cubic feet (12,873 cubic meters)	338,000 cubic feet (9,581 cubic meters)	382,000 cubic feet (10,825 cubic meters)
Annual TRU Waste Generation (includes Mixed TRU)	19,000 cubic feet (537 cubic meters)	19,300 cubic feet (546 cubic meters)	6,700 cubic feet (190 cubic meters)	8,800 cubic feet (250 cubic meters)

TABLE 3.6.2–1.—*Comparison of Potential Consequences of Continued Operations of LANL: Normal Operations*-Continued

RESOURCE AREA	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
Increase in Contaminated Space	Increase of 63,000 square feet (5,900 square meter), as compared to the index.	Increase of 73,000 square feet (6,800 square meter), as compared to the index.	Same as No Action Alternative.	Same as No Action Alternative.
TRANSPORTATION (INCIDENT FREE)				
Public Radiation Exposure (Off-Site Shipments)[a]	• Along route: 3.3 person-rem/year of operation (0.0017 excess LCF/year of operation). • Sharing route: 30 person-rem/year of operation (0.015 excess LCF/year of operation). • At rest stops: 210 person-rem/year of operation (0.11 excess LCF/year of operation). • MEI: 0.0003 rem/year of operation (1.5×10^{-7} excess LCFs/year of operation).	• Along route: 4.2 person-rem/year of operation (0.0021 excess LCF/year of operation). • Sharing route: 37 person-rem/year of operation (0.019 excess LCF/year of operation). • At rest stops: 270 person-rem/year of operation (0.14 excess LCF/year of operation). • MEI: 0.0004 rem/year of operation (1.9×10^{-7} excess LCFs/year of operation).	• Along route: 3.5 person-rem/year of operation (0.0017 excess LCF/year of operation). • Sharing route: 31 person-rem/year of operation (0.015 excess LCF/year of operation). • At rest stops: 230 person-rem/year of operation (0.12 excess LCF/year of operation). • MEI: 0.0003 rem/year of operation (1.6×10^{-7} excess LCFs/year of operation).	• Along route: 3.6 person-rem/year of operation (0.0018 excess LCF/year of operation). • Sharing route: 33 person-rem/year of operation (0.015 excess LCF/year of operation). • At rest stops: 250 person-rem/year of operation (0.12 excess LCF/year of operation). • MEI: 0.0003 rem/year of operation (1.7×10^{-7} excess LCFs/year of operation).
Worker (Drivers) Radiation Exposure[a]	• Off-site: 470 person-rem/year of operation (0.19 excess LCF/year of operation). • On-site: 4.2 person-rem/year of operation (0.0018 excess LCF/year of operation).	• Off-site: 580 person-rem/year of operation (0.23 excess LCF/year of operation). • On-site: 10.3 person-rem/year of operation (0.0041 excess LCF/year of operation).	• Off-site: 510 person-rem/year of operation (0.21 excess LCF/year of operation). • On-site: 4.3 person-rem/year of operation (0.0017 excess LCF/year of operation).	• Off-site: 530 person-rem/year of operation (0.21 excess LCF/year of operation). • On-site: 4.5 person-rem/year of operation (0.0018 excess LCF/year of operation).

[a] Impacts, in terms of excess LCFs per year of operation, are used to quantify the risks of exposure to radiation. When the impact is applied to an individual (e.g., a maximally exposed individual [MEI]), the risk is a lifetime incremental probability of a fatal cancer per year of operation. When applied to a population of individuals, the risk is the incremental number of fatal cancers anticipated in the exposed population for each year of operation.

Note: The impacts of implementing the proposed actions in the Surplus Plutonium Disposition EIS; Lead Test Assembly (chapter 1, section 1.5.8); Siting and Construction, and Operation of the Spallation Neutron Source (chapter 1, section 1.5.9); and Conveyance and Transfer of Certain Land Tracts Located Within Los Alamos County and Los Alamos National Laboratory EIS (chapter 1, section 1.5.10) are summarized in chapter 5, section 5.6.

MGY = million gallons per year; MLY = million liters per year.

TABLE 3.6.2–2.—*Comparison of Potential Consequences of Continued Operations of LANL: Accidents*

ACCIDENT	MEASURE	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
TRANSPORTATION ACCIDENTS[c,f]					
Vehicle Accidents (No Cargo Release)	Accidents per year	4.5	9.0	4.9	5.2
	Resulting injuries per year	3.8	7.6	3.3	3.8
	Resulting fatalities per year	0.38	0.78	0.33	0.44
Release of Radioactive Cargo (Bounding Off-Site Accidents)	Radiation dose (person-rem/year)	2.8	3.0	2.8	3.0
	Resulting excess LCF per year of operation (total along entire route)	0.0014	0.0016	0.0014	0.0016
Release of Radioactive Cargo (Bounding On-Site Accidents)	Plutonium-238: Accidents per year MEI dose (rem) Resulting MEI risk	8.8×10^{-8} 8.7 7.7×10^{-7} rem/yr (3.1×10^{-10} excess LCFs/yr)	1.7×10^{-7} 8.7 1.4×10^{-6} rem/yr (5.8×10^{-10} excess LCFs/yr)	8.8×10^{-8} 8.7 7.7×10^{-7} rem/yr (3.1×10^{-10} excess LCFs/yr)	8.8×10^{-8} 8.7 7.7×10^{-7} rem/yr (3.1×10^{-10} excess LCFs/yr)
	Irradiated targets: Accident frequency MEI consequence Resulting MEI risk	3.1×10^{-6} Acute fatality 3.1×10^{-6} fatalities/yr	3.2×10^{-6} Acute fatality 3.2×10^{-6} fatalities/yr	2.9×10^{-6} Acute fatality 2.9×10^{-6} fatalities/yr	3.2×10^{-6} Acute fatality 3.2×10^{-6} fatalities/yr
Release of Chemical Cargo	Chlorine: Injuries per year (total)	0.006	0.013	0.0056	0.006
	Chlorine: Fatalities per year (total)	0.0016	0.0036	0.0015	0.0016
	Propane: Injuries per year (total)	0.0014	0.0031	0.0014	0.0014
	Propane: Fatalities per year (total)	0.00035	0.00076	0.00032	0.00035
ACCIDENTS (OTHER THAN TRANSPORTATION ACCIDENTS AND WORKER PHYSICAL SAFETY INCIDENTS/ACCIDENTS)[c]					
SITE–01: Site-Wide Earthquake with Severe Damage to Multiple Low-Capacity Facilities[a]	Event frequency (per year)	0.0029	0.0029	0.0029	0.0029
	MEI dose (rem)	20	20	20	20
	Public exposure (person-rem) excess LCF	27,726 16	27,726 16	27,726 16	27,726 16

TABLE 3.6.2–2.—*Comparison of Potential Consequences of Continued Operations of LANL: Accidents*-Continued

ACCIDENT	MEASURE	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
SITE–02: Site-Wide Earthquake with Severe Damage to Multiple Moderate-Capacity Facilities[a]	Event frequency (per year)	0.00044	0.00044	0.00044	0.00044
	MEI dose (rem)	34	34	34	34
	Public exposure (person-rem) excess LCF	41,340 24	41,340 24	41,340 24	41,340 24
SITE–03: Site-Wide Earthquake with Severe Damage to Essentially All Facilities[a,d]	Event frequency (per year)	0.000071	0.000071	0.000071	0.000071
	MEI dose (rem)	247	247	247	247
	Public exposure (person-rem) excess LCF	210,758 134	210,758 134	210,758 134	210,758 134
SITE–04: Site-Wide Wildfire Consuming Combustible Structures and Vegetation	Event frequency (per year)	0.1	0.1	0.1	0.1
	MEI dose (rem)	< 25	< 25	< 25	< 25
	Public exposure (person-rem) excess LCF	675 0.34	675 0.34	669 0.33	675 0.34
RAD–12: Plutonium Release from a Seismically Initiated Event	Event frequency (per year)	approximately 1.5×10^{-6}	approximately 1.5×10^{-6}	approximately 1.5×10^{-6}	approximately 1.5×10^{-6}
	MEI dose (rem)	138	138	138	138
	Public exposure (person-rem) excess LCF	approximately 35,800 18	approximately 35,800 18	approximately 35,800 18	approximately 35,800 18
	Worker Consequences	Any in the facility would be killed by explosion or falling debris	Any in the facility would be killed by explosion or falling debris	Any in the facility would be killed by explosion or falling debris	Any in the facility would be killed by explosion or falling debris

TABLE 3.6.2–2.—*Comparison of Potential Consequences of Continued Operations of LANL: Accidents*-Continued

ACCIDENT	MEASURE	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
CHEM–01: Single Cylinder Chlorine Release from Potable Water Treatment Station (TA–0)	Event frequency (per year)	0.0012	0.0013	0.0011	0.0012
	MEI	NA	NA	NA	NA
	Public exposed to: > ERPG–3 > ERPG–2[b]	 12 43	 12 43	 12 43	 12 43
	Worker consequences	If workers are present, there is potential for worker injury or fatality.	If workers are present, there is potential for worker injury or fatality.	If workers are present, there is potential for worker injury or fatality.	If workers are present, there is potential for worker injury or fatality.
CHEM–02: Multiple Cylinder Chlorine Release from Toxic Gas Storage Facility (TA–3)	Event frequency (per year)	0.00013	0.00015	0.00012	0.00013
	MEI	NA	NA	NA	NA
	Public exposed to > ERPG–3 or > ERPG–2	292	292	292	292
	Worker consequences	Possible injuries or fatalities to workers present at time of accident or responding to accident.	Possible injuries or fatalities to workers present at time of accident or responding to accident.	Possible injuries or fatalities to workers present at time of accident or responding to accident.	Possible injuries or fatalities to workers present at time of accident or responding to accident.
CHEM–03: Single Cylinder Chlorine Release from Toxic Gas Storage Facility (TA–3)	Event frequency (per year)	0.00012	0.00012	0.00012	0.00012
	MEI	NA	NA	NA	NA
	Public exposed to: > ERPG–3 > ERPG–2	 239 263	 239 263	 239 263	 239 263
	Worker consequences	Unlikely that workers are present; but if present, there is potential for worker injury or fatality.	Unlikely that workers are present; but if present, there is potential for worker injury or fatality.	Unlikely that workers are present; but if present, there is potential for worker injury or fatality.	Unlikely that workers are present; but if present, there is potential for worker injury or fatality.

TABLE 3.6.2–2.—*Comparison of Potential Consequences of Continued Operations of LANL: Accidents*-Continued

ACCIDENT	MEASURE	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
CHEM–04: Bounding Single Container Release of Toxic Gas (Selenium Hexaflouride) from Toxic Gas Cylinder Storage (TA–54)	Event frequency (per year)	0.004	0.004	0.004	0.004
	MEI	NA	NA	NA	NA
	Public exposed to: > ERPG–3 > ERPG–2	 0 0	 0 0	 0 0	 0 0
	Worker consequences	Possible injuries or fatalities to up to 5 workers present at time of accident.	Possible injuries or fatalities to up to 5 workers present at time of accident.	Possible injuries or fatalities to up to 5 workers present at time of accident.	Possible injuries or fatalities to up to 5 workers present at time of accident.
CHEM–05: Bounding Multiple Cylinder Release of Toxic Gas (Sulfur Dioxide) from Toxic Gas Cylinder Storage (TA–54)	Event frequency (per year)	0.00051	0.00051	0.00051	0.00051
	MEI	NA	NA	NA	NA
	Public exposed to: > ERPG–3 > ERPG–2	 0 0	 0 0	 0 0	 0 0
	Worker consequences	Possible injuries or fatalities to up to 5 workers present at time of accident.	Possible injuries or fatalities to up to 5 workers present at time of accident.	Possible injuries or fatalities to up to 5 workers present at time of accident.	Possible injuries or fatalities to up to 5 workers present at time of accident.
CHEM–06: Chlorine Gas Release from Plutonium Facility (TA–55) Process Line	Event frequency (per year)	0.063	0.063	0.063	0.063
	MEI	NA	NA	NA	NA
	Public exposed to: > ERPG–3 > ERPG–2	 7 102	 7 102	 7 102	 7 102
	Worker consequences	Unlikely that workers are present; but if present, there is potential for worker injury.	Unlikely that workers are present; but if present, there is potential for worker injury.	Unlikely that workers are present; but if present, there is potential for worker injury.	Unlikely that workers are present; but if present, there is potential for worker injury.

TABLE 3.6.2–2.—*Comparison of Potential Consequences of Continued Operations of LANL: Accidents*-Continued

ACCIDENT	MEASURE	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
RAD–01: Plutonium Release from Container Storage Area Fire Involving TRU Waste Drums (TA–54)	Event frequency (per year)	0.0016	0.0016	0.0016	0.0016
	MEI dose (rem)	46	46	46	46
	Public exposure (person-rem) excess LCF	72 0.04	72 0.04	72 0.04	72 0.04
	Worker consequences	Potential for plutonium inhalation, but no fatalities would be expected.	Potential for plutonium inhalation, but no fatalities would be expected.	Potential for plutonium inhalation, but no fatalities would be expected.	Potential for plutonium inhalation, but no fatalities would be expected.
RAD–03: Reactivity Excursion at Pajarito Site (TA–18) Kiva #3, Vaporizing Some Enriched Uranium Fuel and Melting the Remainder	Event frequency (per year)	3.4×10^{-6}	3.4×10^{-6}	3.4×10^{-6}	3.4×10^{-6}
	MEI dose rem[e]	150	150	150	150
	Public exposure (person-rem) excess LCF	110 0.06	110 0.06	110 0.06	110 0.06
	Worker consequences	No acute fatalities would be expected.	No acute fatalities would be expected.	No acute fatalities would be expected.	No acute fatalities would be expected.
RAD–05: Aircraft Crash with Explosion and/or Fire at TA–21 Resulting in Tritium Oxide Release	Event frequency (per year)	5.3×10^{-6}	5.3×10^{-6}	5.3×10^{-6}	5.3×10^{-6}
	MEI dose (rem)	0.01	0.01	0.01	0.01
	Public exposure (person-rem) excess LCF	24 0.01	24 0.01	24 0.01	24 0.01
	Worker consequences	Aircraft crash could cause injuries and accidents to workers present; workers not affected by crash could be exposed to tritium oxide released by crash.	Aircraft crash could cause injuries and accidents to workers present; workers not affected by crash could be exposed to tritium oxide released by crash.	Aircraft crash could cause injuries and accidents to workers present; workers not affected by crash could be exposed to tritium oxide released by crash.	Aircraft crash could cause injuries and accidents to workers present; workers not affected by crash could be exposed to tritium oxide released by crash.

TABLE 3.6.2–2.—*Comparison of Potential Consequences of Continued Operations of LANL: Accidents*-Continued

ACCIDENT	MEASURE	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
RAD–07: Plutonium Release due to Container Storage Area Fire Involving TRU Waste Drums (TA–50)	Event frequency (per year)	0.00015	0.0003	0.00011	0.00015
	MEI dose (rem)	74	74	74	74
	Public exposure (person-rem) excess LCF	1,300 0.69	1,300 0.69	1,300 0.69	1,300 0.69
	Worker consequences	No acute fatalities would be expected.	No acute fatalities would be expected.	No acute fatalities would be expected.	No acute fatalities would be expected.
RAD–08: Aircraft Crash with Explosion and/or Fire at the TRU Waste Area at TA–54	Event frequency (per year)	4.3×10^{-6}	4.3×10^{-6}	4.3×10^{-6}	4.3×10^{-6}
	MEI dose (rem)	22	22	22	22
	Public exposure (person-rem) excess LCF	400 0.2	400 0.2	400 0.2	400 0.2
	Worker consequences	Aircraft crash could cause injuries and fatalities to workers present; workers not affected by crash could be exposed to plutonium released by crash.	Aircraft crash could cause injuries and fatalities to workers present; workers not affected by crash could be exposed to plutonium released by crash.	Aircraft crash could cause injuries and fatalities to workers present; workers not affected by crash could be exposed to plutonium released by crash.	Aircraft crash could cause injuries and fatalities to workers present; workers not affected by crash could be exposed to plutonium released by crash.
RAD–09: Transuranic Waste Drum Failure or Puncture at TA–54, Area G (results are for typical drum)	Event frequency (per year)	0.4	0.49	0.4	0.4
	MEI dose (rem)	0.41	0.41	0.41	0.41
	Public exposure (person-rem) excess LCF	4.3 0.002	4.3 0.002	4.3 0.002	4.3 0.002
	Worker consequences	Some workers could inhale plutonium (dose would depend on protective measures taken), but no acute fatalities would be expected.	Some workers could inhale plutonium (dose would depend on protective measures taken), but no acute fatalities would be expected.	Some workers could inhale plutonium (dose would depend on protective measures taken), but no acute fatalities would be expected.	Some workers could inhale plutonium (dose would depend on protective measures taken), but no acute fatalities would be expected.

TABLE 3.6.2–2.—*Comparison of Potential Consequences of Continued Operations of LANL: Accidents*-Continued

ACCIDENT	MEASURE	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
RAD–13: Plutonium Melting and Release Accident at Pajarito Site (TA–18) Kiva #3	Event frequency (per year)	0.000016	0.000016	0.000016	0.000016
	MEI dose (rem)	120	120	120	120
	Public exposure (person-rem) excess LCF	160 0.08	160 0.08	160 0.08	160 0.08
	Worker consequences	No acute fatalities would be expected.	No acute fatalities would be expected.	No acute fatalities would be expected.	No acute fatalities would be expected.
RAD–15: Plutonium Release from a Wing Fire at the CMR Building (in TA–3)	Event frequency (per year)	0.000032	0.000032	0.000032	0.000032
	MEI dose (rem)	40	91	40	40
	Public exposure (person-rem) excess LCF	1,700 0.85	3,400 1.7	1,700 0.85	1,700 0.85
	Worker consequences	1 to 3 workers present in accident location could be injured or killed due to fire; if not killed, could inhale plutonium. Other workers in the area could be affected by smoke inhalation.	1 to 3 workers present in accident location could be injured or killed due to fire; if not killed, could inhale plutonium. Other workers in the area could be affected by smoke inhalation.	1 to 3 workers present in accident location could be injured or killed due to fire; if not killed, could inhale plutonium. Other workers in the area could be affected by smoke inhalation.	1 to 3 workers present in accident location could be injured or killed due to fire; if not killed, could inhale plutonium. Other workers in the area could be affected by smoke inhalation.

TABLE 3.6.2–2.—*Comparison of Potential Consequences of Continued Operations of LANL: Accidents*-Continued

ACCIDENT	MEASURE	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
RAD–16: Aircraft Crash with Explosion and/or Fire at the CMR Building (in TA–3) Resulting in a Plutonium Release	Event frequency (per year)	3.5×10^{-6}	3.5×10^{-6}	3.5×10^{-6}	3.5×10^{-6}
	MEI dose (rem)	3	3	3	3
	Public exposure (person-rem) excess LCF	56 0.03	56 0.03	56 0.03	56 0.03
	Worker consequences	Aircraft crash could cause injuries and accidents to nearly all workers in the building; workers not affected by crash could be exposed to plutonium released by crash.	Aircraft crash could cause injuries and accidents to nearly all workers in the building; workers not affected by crash could be exposed to plutonium released by crash.	Aircraft crash could cause injuries and accidents to nearly all workers in the building; workers not affected by crash could be exposed to plutonium released by crash.	Aircraft crash could cause injuries and accidents to nearly all workers in the building; workers not affected by crash could be exposed to plutonium released by crash.
WORK–01: Worker Fatality Due to Inadvertent High Explosives Detonation	Event frequency (per year)	0.001 to 0.01	0.0015 to 0.015	0.0008 to 0.008	0.0006 to 0.006
	Worker injuries or fatalities	1 to 10 injuries or fatalities.	1 to 10 injuries or fatalities.	1 to 10 injuries or fatalities.	1 to 10 injuries or fatalities.
WORK–02: Worker Illness or Fatality Due to Inadvertent Biohazard Contamination	Event frequency (per year)	0.01 to 0.1	0.01 to 0.1	0.01 to 0.1	0.01 to 0.1
	Worker injuries or fatalities	1 injury or fatality.	1 injury or fatality.	1 injury or fatality.	1 injury or fatality.
WORK–03: Multiple Worker Fatality Due to Inadvertent Nuclear Criticality Event	Event frequency (per year)	< 0.00001	< 0.00001	< 0.00001	< 0.00001
	Worker exposures or fatalities	Substantial doses and possible fatalities.	Substantial doses and possible fatalities.	Substantial doses and possible fatalities.	Substantial doses and possible fatalities.
WORK–04: Worker Injury or Fatality Due to Inadvertent Nonionizing Radiation Exposure	Event frequency (per year)	0.01 to 0.1	0.01 to 0.1	0.01 to 0.1	0.01 to 0.1
	Worker injuries or fatalities	Typically 1, rarely several, injuries or fatalities.	Typically 1, rarely several, injuries or fatalities.	Typically 1, rarely several, injuries or fatalities.	Typically 1, rarely several, injuries or fatalities.

TABLE 3.6.2–2.—*Comparison of Potential Consequences of Continued Operations of LANL: Accidents*-Continued

ACCIDENT	MEASURE	NO ACTION	EXPANDED OPERATIONS	REDUCED OPERATIONS	GREENER
WORK–05: Worker Exposure to Plutonium Released from a Degraded Storage Container at TA–55	Event frequency (per year)	0.23	0.23	0.23	0.23
	Worker injuries or fatalities	1 or 2 workers potentially exposed to plutonium inhalation.	1 or 2 workers potentially exposed to plutonium inhalation.	1 or 2 workers potentially exposed to plutonium inhalation.	1 or 2 workers potentially exposed to plutonium inhalation.

[a] Workers in buildings that are structurally damaged or collapse could be injured or killed, but the number of workers injured or killed cannot be predicted a priori. Worker excess latent cancer fatalities due to radiological releases in an earthquake and worker injuries or fatalities due to chemical releases in an earthquake are expected to be small or modest increments to the impacts directly attributable to the earthquake (e.g., the collapse of structures). The estimates of event frequencies and impacts are conservative.

[b] ERPG–2 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without irreversible or serious health effects or symptoms that could impair their abilities to take protective action. ERPG–3 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without life-threatening health effects.

[c] Impacts, in terms of excess LCFs per year of operation, are used to quantify the risks of exposure to radiation. When the impact is applied to an individual (e.g., a maximally exposed individual [MEI]), the risk is a lifetime incremental probability of a fatal cancer per year of operation. When applied to a population of individuals, the risk is the incremental number of fatal cancers anticipated in the exposed population for each year of operation.

[d] There is a potential for fault rupturing to occur at the CMR Building (TA–3–29) at a somewhat lower frequency than the SITE–03 earthquake (estimated at 1 to 3 x 10^{-5} per year). Should this occur in association with the SITE–03 earthquake, a conservative estimate results in an additional 133,833 person-rem population exposure (increasing LCFs by 99), and an increase to the MEI of 134 rem.

[e] The MEI dose is provided, under this accident scenario, for an individual located on Pajarito Road at a distance of 50 meters from the facility, even though Pajarito Road would be closed to the public during outdoor operations.

[f] Transportation accidents are typically calculated using computer codes, considering varying accident rates for route types, varying populations along the routes, and other factors. The calculated risks are presented as the product of the accident frequency and the accident consequence; for such calculations, the frequency and consequence terms are not readily accessible from the calculational results. As such, this table reflects the risks associated with transportation accidents, but generally does not separately present the consequence and frequency terms. The on-site radioactive transportation analyses were done by hand calculations, and for these accidents, frequency, consequence, and risk are all presented separately in the table.

Note: Often, there are no differences between accident impacts among the alternatives, largely as a result of conservative approaches used in accident frequency and public consequence. The inventories used in the analyses are typically those of permitted or administrative limits (i.e., controls on the maximum amounts of material that can be processed at one time and/or in storage), rather than operational values (i.e., the actual amount of material needed to perform the task). The operational values would be more likely to change among the alternatives. The administrative limits or inventories are selected so that the analyses are sufficiently conservative and bounding to cover maximum possible operational values. The accident frequencies depend upon the accident initiators, such as an aircraft crash, earthquake, or wildfire. These particular initiators are independent of the operations and of inventory; therefore, the frequency or likelihood of such an event remains constant among the alternatives. In the few cases of accidents in which the frequency depends upon operations, the variation in frequency among the alternatives does not necessarily translate into a significant change in the risk of an environmental release to the public because the value of a release is very small. Likewise, the risk to workers is affected by the change in frequency of the operations; but, the consequence of a single accident remains the same.